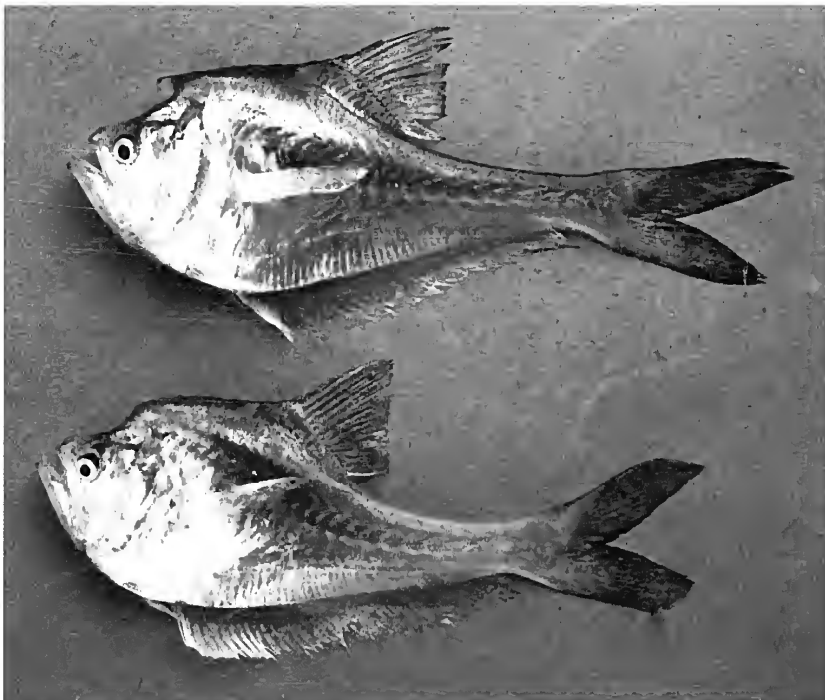


The *Beagle*

*Records of the Museums and Art Galleries
of the Northern Territory*

Volume 17

December 2001



The Beagle, Records of the Museums and Art Galleries of the Northern Territory

(formerly 'Records of the Northern Territory Museum of Arts and Sciences')

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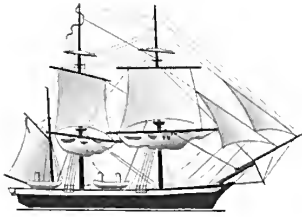
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ISSN 0811-3653

Printed by the Government Printer of the Northern Territory



Front cover: Male (top) and female nursery fish, *Kurtus gulliveri*, from Adelaide River (see T.M. Berra and D. Wedd, pages 21-25). Both are approximately 170 mm standard length. Photographed alive immediately after capture. Photograph copyright: Tim M. Berra.



The Beagle

RECORDS OF THE MUSEUMS AND ART GALLERIES
OF THE NORTHERN TERRITORY

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The conservation status of plants used in *ikat* cloth production in Melolo, East Sumba, Indonesia

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ABSTRACT

The names and uses of ten plants commonly used to produce dyes and mordants for use in *ikat* cloth making in East Sumba, Indonesia, are presented. The effects of harvesting for *ikat* production on the conservation status of the plants are discussed, and are found to be sustainable for nine species. The use of *Symplocos fasciculata* appears to be threatening the local populations, even though the species is widespread in Malesia. The use of a commercial mordant to satisfy the tourist industry is recommended.

KEYWORDS: *Ikat*, ethnobiology, *Symplocos fasciculata*, Melolo, Sumba, Indonesia.

INTRODUCTION

The aim of this paper is to record the plants used in the production of *ikat* cloth, and to assess the effects of this use on the plants' conservation status in relation to occurrence and distribution in East Sumba. While the names of some plants used in the *ikat* process have been recorded (e.g. Warming and Gaworski 1981, Hitchcock 1991), the effect of harvest on the conservation status has not been assessed.

Ikat is a traditional tie-dye method of decorating cotton cloth, dating back to AD 939 (Hitchcock 1991) and cloth is generally made into blankets, rugs, shawls and clothing. It is traditionally practiced in a few areas in eastern Indonesia, mainly Sumba, but also Bali, Flores and some other small islands. There is significant variation in technique and plants used in the process throughout Indonesia (Warming and Gaworski 1981).

Ikat cloth produced in East Sumba (see Fig. 1) is renowned throughout Indonesia as being of the highest quality and complexity of design. Traditional *ikat* cloth still plays an important role in the cultural and ceremonial life of the people of Sumba.

The fibre used to weave *ikat* is made from cotton (*Gossypium hirsutum*), generally purchased commercially, though occasionally grown on Sumba. The fibre is dyed and then woven on a loom. The process is very time consuming with larger pieces taking up to a

year to complete. Colours traditionally used were red, blue, purple (obtained by mixing red and blue), black (obtained by adding a darkening mordant and dyeing the fibre several times) and very rarely, yellow.

In recent times commercial dyes are being used as they are easier to obtain and quicker to use; they are particularly used to produce *ikat* for the tourist market. Whilst these dyes are considered inferior by Sumbanese artists, their use has had the effect of reducing the harvesting pressure on plants traditionally used as dyes and mordants.

METHODS

Information relating to plants used in *ikat* production was collected in March 1999 at Melolo in East Sumba, Indonesia (Fig. 2). Data collection was undertaken via informal interviews with Kanaweo Kana and Katarina Kana who are senior residents of Melolo and considered knowledgeable about *ikat*. Direct observation of preparation of some of the dyes also occurred. Data were also collected by interview and direct observation during a broader survey of useful plants in East Sumba during 1997 and 1998 (S. Hidayat and coll., unpublished data).

Plant scientific names follow that in use at Herbarium Bogoriense (BO), while family names follow Mabberley (1990). Voucher specimens for each species are lodged at Herbarium Bogoriense in Bogor, West Java.



Fig. 1. 'Double ikat' weaving and completed cloths from Tenganan, Bali, Indonesia.

RESULTS

Information is presented alphabetically by scientific name, with family following. The local name (generally from the Kambera language) used in East Sumba for

the species is given in bold italics, right justified on the first line. Information about each plant is presented in the following order: use of plant in *ikat* cloth production; habitat and distribution in East Sumba; broader distribution; apparent effects of harvesting for *ikat*.

Caesalpinia sappan, Leguminosae

Hapang

The stems are used to obtain a red dye. The stem is pounded and soaked in water in a vessel. The fibre to be dyed is then soaked in the red liquid. This species is not commonly used to obtain a red dye, as *kombu* (*Morinda citrifolia*) is preferred.

Hapang is uncommon, and is found in the foothills and up to 300 m above sea level, generally in forest areas. It also occurs throughout south-east Asia and is cultivated and naturalised in Malesia, India, Taiwan and the Pacific. It is a prickly, scrambling, multi-stemmed plant, which is often eaten by cattle. The harvest of some or all of the stems to obtain dye generally does not kill the plant.

The harvest for *ikat* does not effect the conservation status of this species. However, in conjunction with destruction by cattle and habitat clearing, its range and population numbers could be reduced.

Ceriops tagal, Rhizophoraceae

Biko

The red inner bark is used to obtain a red dye. The bark is sun dried and then powdered. The powder is added to water where it produces a red dye. This species is not often used for *ikat*, as *kombu* (*Morinda citrifolia*) is preferred.

This species is common in landward mangrove areas in East Sumba. It also occurs from eastern Africa to India, through Asia to Australia and the Pacific. The removal of patches of bark usually does not kill the plant, though complete bark loss over a large area can be fatal.

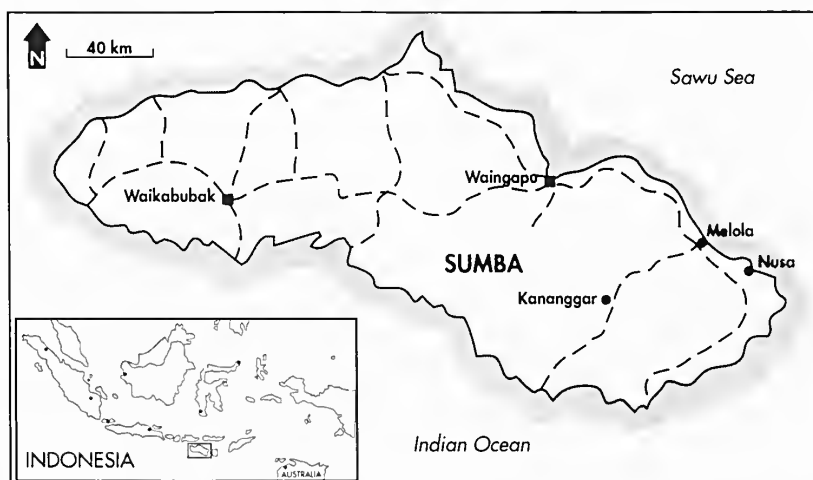


Fig. 2. Locality map of field sites on Sumba, Indonesia.



Fig. 3. Katarina Kana crushing the leaves of *wora*, *Indigofera tinctoria*, with lime and water, Melolo, Sumba, Indonesia.

The use of this species in *ikat* does not effect its conservation status.

Dendrobium affine, Orchidaceae

Dadilai

The pseudobulbs are scraped and a green, sticky juice is obtained. This juice is rubbed into the tassels at each end of *ikat* cloth. It produces a smooth finish and prevents the fibres of the tassels from fraying. However, it is not used on all *ikat* cloth as many pieces have loose fibre at the ends, not tassels.

This species is common in forest areas in East Sumba, and also occasionally found in mangrove forests. It also occurs in Timor, New Guinea and northern Australia. The bulbs are collected a few at a time from each plant, allowing continued production of new pseudobulbs. Each pseudobulb furnishes a fairly large quantity of 'glue', which is used sparingly on tassels.

The use for *ikat* does not threaten the conservation status of this species.

Indigofera tinctoria, Leguminosae

Wora

The leaves are used to obtain a blue-coloured dye. The leafy twigs are harvested in the wet season when

this species is available. The leaves are soaked in water for a short period, then handfuls, with a large pinch of lime powder, are vigorously crushed and squeezed in the same bowl in which they were soaking (Fig. 3). The crushed leaves, lime and water are allowed to soak overnight and then the leaves and twigs are taken out in the morning. Overnight, the mixture separates into an upper layer of grey-coloured liquid and a lower layer of dark blue water and sediment. The upper level provides a light grey-coloured dye, while the lower level, which also contains sediment, produces a dark blue dye (Fig. 4). After three days of soaking, the sediment becomes black.

This species is of Asian origin but now has a pantropical distribution. It is common during the wet season in East Sumba, growing in gardens, forest margins, roadsides and occasionally in savanna areas. The leafy twigs are stored in vessels for use during the dry season. Harvesting of this species does not kill plants as only the leafy twigs are taken. This species is extensively used to produce the popular blue colour seen in most *ikat*.

The use of this species for *ikat* does not affect its conservation status.

Maclura cochinchinensis, Moraceae

Taramanu

The wood is used to obtain a yellow dye. The wood is chipped off the trunk of this woody, erect climber, generally in a fashion that does not kill the plant. The wood is occasionally sold for up to Rp20,000 (SAUD 4) for one kilo to other handicraft centres in Indonesia. It is not commonly used for dyeing as yellow colours are not often seen in *ikat* cloth, but when present are generally from commercial dyes.

This species occurs in forest areas, but is uncommon in East Sumba. It has a wide distribution from Nepal and India to Japan and through Malesia to eastern Australia.

Given that harvest generally does not kill the plant, and is rarely undertaken, the use of this species for *ikat* does not appear to threaten the species.

Morinda citrifolia, Rubiaceae

Kombu

The bark of the roots is used to obtain a red dye. This is the preferred red dye for most artisans and it is extensively used in East Sumba. The roots are harvested from the base of the tree leaving enough roots for the tree to survive and replace the roots taken. The root bark is chipped off and pounded, often using a large mortar and pestle. Water is added to produce the red dye. The colour may be strengthened and darkened by pounding the bark and leaf of *luaba* (*Symplocos fasciculata*) at the same time as the root bark. The fibre to be dyed is first soaked in the oil of *Aleurites moluccana* then sun-dried. When dry, it is soaked in the dye from *kombu*, or *kombu* and *luaba* together.



Fig. 4. The blue colour from *wora*, *Indigofera tinctoria*, on Katarina Kana's hands after preparing the dye, Melolo, Sumba, Indonesia.

Kombu is found in coastal forest areas and behind mangroves; and is also grown in some gardens for use as a dye. This species is fairly common and widespread in East Sumba; it also occurs in northern Australia and is widespread in south-east Asia and the Pacific.

Given the continued non-lethal form of root harvesting, the use of this plant in *ikat* will not change its conservation status.

Pahabori, Kalihi wanangu

Pittosporum moluccanum, Pittosporaceae

The stem bark is used to obtain a black dye which may also be used as a mordant to strengthen and darken other colours. The bark is chipped off the trunk and then pounded, and water is added. Fibre to be dyed is soaked in this dark liquid, to produce a dark or black colour. The pounded bark may be added to other dye materials as a mordant. This species is not commonly used in *ikat* production.

This species is relatively common in the inland forest areas of East Sumba. The bark harvest is generally non-lethal but may result in the occasional death of individual trees.

The use of this species in *ikat* does not appear to threaten the species.

Rhizophora apiculata*, Rhizophoraceae *Kayu douga

The stem bark is used to make a red dye. The bark is chipped off and pounded, then water is added. The fibre to be dyed is then soaked in this liquid. *Kombu* (*Morinda citrifolia*) is preferred as a red dye and *kayu douga* is only used when *kombu* is not available.

This plant occurs in mangrove forests in East Sumba, especially those that receive some fresh water input all year round. It is relatively common in the landward areas of mangroves. It also occurs from Sri Lanka to the Pacific, including northern Australia. This species is

capable of withstanding significant lower stem bark removal, in part due to the copious aerial roots it produces which bypass the lower trunk. It is unlikely that bark removal from the lower stem could kill this plant.

The use of this species in *ikat* does not affect its conservation status.

***Sterculia foetida*, Sterculiaceae**

Kelumbang

The fruit mesocarp is used as a mordant, to make colours more vibrant and to last longer. The soft portions of the inner fruit are burned to ash and then water is added. The resulting liquid is added to any dye to make it vibrant and longer lasting.

Sterculia foetida is common in savanna areas in East Sumba; it also occurs from eastern Africa to India, Malaysia, eastern Australia and Hawaii. The mesocarp is obtained from fallen fruit that have already shed the seeds.

Kelumbang in *ikat* production does not affect the conservation status of this species.

***Synplocos fasciculata*, Synplocaceae**

Luaba

The bark and leaves are used as a mordant. However, the bark is preferred as it has stronger effects. The leaves and bark may be pounded and added to dye or soaked in water and the resulting liquid added as a mordant to make existing dyes brighter and longer lasting.

This plant is found in elevated, primary forest and open, secondary forest and thicket areas, and is also common in disturbed areas. *Luaba* is apparently restricted in distribution in East Sumba and eastern Indonesia. However, this species also occurs in southern Thailand, Malaysia, the Philippines and in Indonesia mainly in Borneo, Java and Sulawesi, where it is relatively common (Nooteboom 1977). The sparse populations in Sumba appear to represent the most easterly range of the species in Indonesia.

People from Melolo travel past Kananggar, a trip of 5-6 hours, to obtain bark and leaves. Often entire stems are cut down to obtain bark, which results in the death of the plant. Large bags of leaves and bark are available for purchase at the Melolo and Waingapu markets, where it is sold in small bundles for 500Rp (\$AUD 0.10).

The harvesting of bark and leaves for use in *ikat* production could threaten the conservation status of the few populations of this species in East Sumba.

DISCUSSION

From our observations of plants used in *ikat* cloth production in East Sumba (Table 1), most processes are non-lethal and appear not to threaten the species involved. The most widely used dyes, from *Morinda citrifolia* and *Indigofera tinctoria*, are common and currently used in a sustainable fashion.

Table 1. Plants used in producing *ikat* in East Sumba, Indonesia. * These species have also been recorded in the following publications as being used in *ikat* production: 1; Hitchcock 1991; 2; Warming and Gaworski 1981; 3; Lemens and Wulijarni-Soetjipto 1992 [this reference refers to dyes but not *ikat* specifically].

Scientific name, references	Family	Local name	Part used	Effect produced
<i>Caesalpinia sappan</i> L. * ^{1,3}	Leguminosae	<i>hapang</i>	Stem	Red colour
<i>Ceriops tagal</i> (Perr.) C.B.Rob * ^{1,3}	Rhizophoraceae	<i>biko</i>	Bark	Red colour
<i>Dendrobium affine</i> Steud.	Orchidaceae	<i>dadilai</i>	Pseudobulb	Glue for tassels
<i>Indigofera tinctoria</i> L. * ^{1,2,3}	Leguminosae	<i>wora</i>	Leaf	Blue colour
<i>Maclura cochinchinensis</i> (Lour.) Corner * ³	Moraceae	<i>taramanu</i>	Wood	Yellow colour
<i>Morinda citrifolia</i> L. * ^{1,2,3}	Rubiaceae	<i>kombu</i>	Root	Red colour
<i>Pittosporum moluccanum</i> (Lam.) Miq.	Pittosporaceae	<i>kalili</i>	Bark	Black colour
<i>Rhizophora apiculata</i> Blume	Rhizophoraceae	<i>kayu donga</i>	Bark	Black colour
<i>Sterculia foetida</i> L.	Sterculiaceae	<i>kolumbang</i>	Inner fruit	Mordant
<i>Symplocos fasciculata</i> Zoll. * ^{1,3}	Symplocaceae	<i>luaba</i>	Bark	Mordant

However, the use of *Symplocos fasciculata* does not appear to be sustainable based on the type of harvest and its restricted distribution on Sumba, and in fact in eastern Indonesia. Unfortunately there are no published reports regarding the population dynamics or reproductive biology for this taxon. It appears that the continued destructive harvesting of *Symplocos fasciculata* for use as an *ikat* dye could result in the local extinction on Sumba, or at least in certain areas.

It may be necessary to introduce measures to control its harvest or provide an easily obtained replacement mordant. Given the difficulties and costs involved in monitoring the use and possible rehabilitation of *Symplocos fasciculata*, it may be simpler and more effective to identify a commercial mordant to introduce to the commercial and tourist *ikat* industry in East Sumba.

The use of *Symplocos fasciculata* for ceremonial and spiritual items is expected to continue, as the use of a non-traditional dye is considered culturally improper. However, this represents only a small part of the total *ikat* industry, significantly less than 10%, as only a few of these items are produced annually.

The people in the *ikat* industry in East Sumba have already demonstrated an ability and willingness to use commercial dyes. This has greatly reduced the collecting pressure on the plants producing traditional dyes. Consequently it has increased the long-term sustainability of the industry, even though *ikat* cloth production has increased dramatically in the last 15 years to cope with demands from an expanded tourist market in eastern Indonesia.

ACKNOWLEDGMENTS

To our *ikat* plant use mentors, Kanaweo Kana and Katarina Kana of Melolo, we offer sincere thanks. Oktovanius, our guide and driver at Melolo, was also particularly capable and helpful.

Frank Zich, Ida Bagus Komang Arsana and Ida Bagus Ketut Arinasa of the Indonesian Botanic Gardens assisted with data collection in 1997 and 1998. Greg Leach and Bill Freeland of the Parks and Wildlife Commission of the Northern Territory provided comments on a draft of this paper. Wanda Avc of Leiden University kindly assisted with tracking down references. Lily Coates provided Figure 2.

The Australian Centre for International Agricultural Research provided funding for useful tree assessment work we were undertaking at Luku Melolo in East Sumba. This research led to the production of this paper. Particularly, we thank Heather Crompton for her support and encouragement.

REFERENCES

- Hitchcock, M. 1991. *Indonesian Textiles*. British Museum Press: London.
- Lemens, R.H.M.J. and Wulijarni-Soetjipto, N. (eds) 1992. *Dye and tannin-producing plants*. PROSEA No. 3, Bogor, Indonesia.
- Mabberley, D.J. 1990. *The plant-book; a portable dictionary of the higher plants*. Cambridge University Press, Cambridge.
- Nooteboom, H.P. 1977. Symplocaceae. *Flora Malesiana*, Series 1(8): 205-274.
- Warming, W. and Gaworski, M. 1981. *The world of Indonesian textiles*. Kodansha International, Tokyo, Japan.

Accepted 28 August 2001

The medicinal value of *lalap* (raw vegetable) in Sundanese society at Bogor, West Java, Indonesia

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ABSTRACT

Information about the use of plants as *lalap* (raw vegetables) by Sundanese people at Bogor in West Java, Indonesia, is presented. Many of the raw vegetables have well known and effective medicinal qualities. Several species of *lalap* are becoming less common due to reduction of suitable habitat, increased human population pressures, technological developments and the loss of traditional knowledge of plant uses. Tables of the *lalap* plants and their medicinal uses are included.

KEYWORDS: *Lalap*, vegetable, medicinal plants, Sundanese, Java, Indonesia.

INTRODUCTION

Wild collected and cultivated vegetables are a vital part of day to day life in south-east Asia, and form the basis of the market stalls in most cities and villages. There is a significant amount of published literature available (for example, Siemonsma and Kasem Piluek 1994), but it almost invariably refers to country or regional use of vegetable plants from an agricultural perspective. This paper looks at the use of raw vegetables as medicines in a small area, and evaluates the significance of this use on the conservation status of the species. There appears to be no published literature of a similar nature.

Bogor is located in the province of Jawa Barat, at the western end of the island of Java, in the Republic of Indonesia (Fig. 1). The Indonesian capital, Jakarta, is about 60 kilometres to the north. There are many markets in Bogor and surrounding areas that primarily sell various vegetable foods.

Bogor has a population of about 400,000 people, many of whom are of Sundanese descent. The Bogor area is very densely populated, as is most of West Java. Due to this dense population there is significant pressure on wild and cultivated edible plant resources.

Plants sourced from the wild for sale at the markets are gathered from the less densely populated slopes of Mount Salak and Mount Gede Pangrango, to the south-west of Bogor.

The Sundanese people of West Java use many edible plant species as raw vegetables, which are commonly referred to as *lalap*. The majority of these *lalap* are also considered to be important medicinal plants and they are often consumed for their medicinal qualities as much as for their food value.

Some *lalap* plants are becoming uncommon in the wild due to harvesting for personal consumption or for commercial sale at markets. It seems likely that some taxa will become locally or regionally endangered if this continues.

Another reason for the reduction of the availability of *lalap* in the wild is land being converted to urban areas. Technological developments which lead to the production of mass-produced fast foods also reduce the sociological importance of traditional, labour intensive foods harvested from the wild.

Further, it is suggested that the traditional Sundanese knowledge of the names, uses, distribution and local occurrences of these species is not being 'passed on' to younger Sundanese generations due to recent and continuing lifestyle changes.

METHODS

The information presented here is based upon informal interviews conducted with Sundanese stall-holders at seven different markets in Bogor in Indonesia.

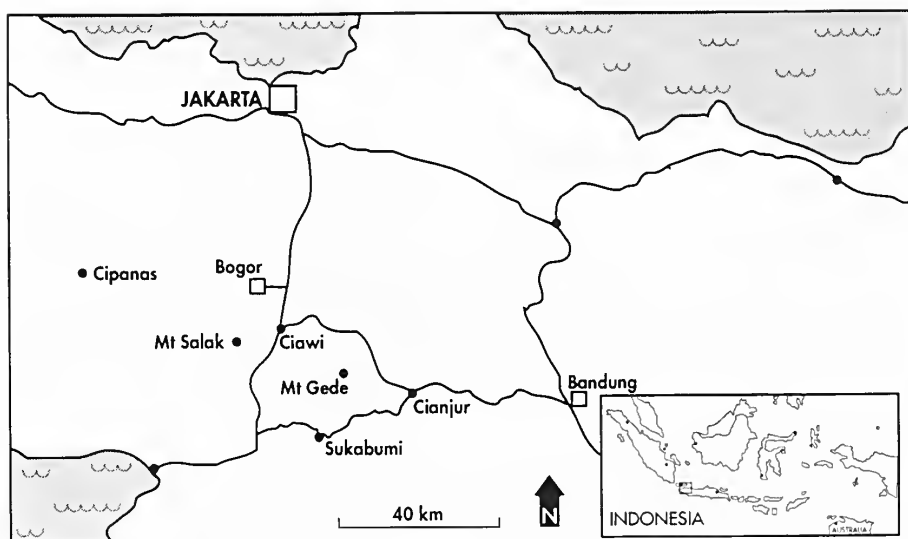


Fig. 1. Locality map of Bogor area, West Java, Indonesia.

Surveys were undertaken on Saturday and Sunday mornings, from 5.00 to 7.00 a.m. when the stalls were most fully stocked with *lalap* prior to the days' sales.

Each market was surveyed two or three times. Surveys were undertaken during the 'dry season' in August 1993 and the 'wet season' in January 1994. Plants were identified on site at the market with their Sundanese and scientific names, and further identification was undertaken at Herbarium Bogoriense when necessary. Names, uses and scientific data were corroborated in relevant published literature including Burkill (1966), Ochse (1977) and Siemonsma and Kasem Piluek (1994), Astuti *et al.* (1995).

Scientific names are based on those in use at Kebun Raya Indonesia (Indonesian Botanic Gardens) and Herbarium Bogoriense (BO). Plant family names are based on those used by Mabberley (1997), and generic names on those listed by Brummitt (1992).

A broad outline of the use of vegetables in south-east Asia is available in Siemonsma and Kasem Piluek (1994). It includes most of the species presented in this paper, but does not reflect the medicinal uses of the plants. There appears to be no other published literature relating to the medicinal value of *lalap* and changes in abundance of these plants.

RESULTS

Raw vegetables recorded at the markets that are also used as medicines are listed in Table 1. Raw vegetables that have no known medicinal properties are listed in Table 2. The markets that data were collected from, together with the dominant *lalap* species for sale at each market during the wet and dry seasons, are listed in Table 3.

DISCUSSION

Taxonomic statistics. The results of informal interviews with stallholders at seven fresh vegetable markets in Bogor indicate that 37 plant species from 20 families, which are used for *lalap*, also have significant medicinal qualities. An additional 12 species, from eight families, are used as *lalap* but have no known medicinal properties.

Plants from the families Compositae (5 species), Cucurbitaceae (4 species) and Leguminosae (4 species) are most widely used as medicinal *lalap*. The families Cruciferae, Euphorbiaceae, Solanaceae (3 species) and Umbelliferae (2 species) also have more than one taxon used as medicinal *lalap*. Thirteen families have a single taxon that is used as medicinal *lalap*. *Lalap* plants occupy a broad taxonomic range over many genera. Only *Solanum* (3 species) and *Lactuca* and *Erechtites* (2 species) have more than one species utilised. Thirty-three genera have one species used as *lalap*.

***Lalap* resource sustainability.** Several medicinal *lalap* plants are becoming less common in the wild and in cultivation due to harvesting for sale at markets and the use of these plants for personal consumption. The main species affected are: *Maesa blumei* (*kipiit*), *Symplocos odoratissima* (*kisariawan*), *Oroxylum indicum* (*pongporong*) and *Staurogyne elongata* (*reuden*).

Several medicinal *lalap* plants are also becoming less common in the market place. The main species affected are: *Anacardium occidentale* (*mede*), *Cosmos caudatus* (*randamidang*), *Selaginella willdenowii* (*rane*) and *Erechtites hieracifolia* (*tespung*).

Table 1. *Lalap* (raw vegetables) used as traditional Sundanese medicine.

Sundanese name	Scientific name and family	Edible portion	Ailment treated	Main source in Java
<i>Antanan</i>	<i>Centella asiatica</i> Umbelliferae	leaf	stomach-ache, high fever, lack of appetite	common in wild
<i>Baluntas</i>	<i>Pluchea indica</i> Compositae	leaf	body odour, fever	cultivated
<i>Bonteng</i>	<i>Cucumis sativus</i> Cucurbitaceae	fruit	hypertension, stomatitis (mouth ulcers)	cultivated
<i>Cangkudn</i>	<i>Moriuda citrifolia</i> Rubiaceae	young fruit, leaf	hypertension (high blood pressure)	common in wild
<i>Cikur</i>	<i>Kaempferia galanga</i> Zingiberaceae	leaf, rhizome	internal injury, pertussis (whooping cough), gastritis, lack of appetite	commonly cultivated
<i>Dadap</i>	<i>Erythrina variegata</i> Leguminosae	young leaf	fever, insomnia	uncommon in wild
<i>Gambas</i>	<i>Sechium edule</i> Cucurbitaceae	young leaf, fruit	stomatitis (mouth ulcers)	commonly cultivated
<i>Gedang</i>	<i>Carica papaya</i> Caricaceae	leaf, young fruit, flower	anemia, icteric hepatitis, malaria	commonly cultivated
<i>Jaat</i>	<i>Psopocarpus tetragonolobus</i> Leguminosae	fruit	furunculosis (severe boils)	commonly cultivated
<i>Kadondong lant</i>	<i>Polyscias fruticosa</i> Araliaceae	young leaf	uremia (kidney failure), nephritis (kidney inflammation)	common in wild
<i>Katuk</i>	<i>Sauropus androgynus</i> Euphorbiaceae	leaf	laktagoga (lack of milk in nursing mother)	commonly cultivated
<i>Kidewa</i>	<i>Gynura procumbens</i> Compositae	leaf	pharyngitis (inflammation of pharynx), cancer	uncommon in cultivation
<i>Kipiit</i>	<i>Maesa blumei</i> Myrsinaceae	leaf	childbirth recovery	uncommon in wild
<i>Kisariawan</i>	<i>Symplocos odoratissima</i> Symplocaceae	leaf	stomatitis (mouth ulcers)	rare in West Java
<i>Kinrat</i>	<i>Plantago major</i> Plantaginaceae	leaf	nephritis (kidney inflammation), uremia (kidney failure)	uncommon in wild
<i>Kuca</i>	<i>Allium odorum</i> Alliaceae	all parts	fever, stomach-ache	commonly cultivated
<i>Lampenas</i>	<i>Lactuca indica</i> Compositae	leaf	nephritis (kidney inflammation), lumbago, mastitis	common in wild
<i>Lennca</i>	<i>Solanum nigrum</i> Solanaceae	leaf, fruit	conjunctivitis	common in wild
<i>Lobak</i>	<i>Raphanus sativus</i> Cruciferae	leaf, tuber	dyspepsia (indigestion)	commonly cultivated
<i>Mareme</i>	<i>Glochidion rubrum</i> Euphorbiaceae	leaf	used as an expectorant	uncommon in wild
<i>Mede</i>	<i>Anacardium occidentale</i> Anacardiaceae	young leaf	tonsillitis, stomatitis (mouth ulcers)	uncommon in cultivation
<i>Paria</i>	<i>Momordica charantia</i> Cucurbitaceae	fruit	malaria, lack of appetite	commonly cultivated
<i>Palanding</i>	<i>Lencana lencoecephala</i> Leguminosae	fruit	diabetes mellitus	common in wild, cultivated
<i>Peuteny</i>	<i>Parkia speciosa</i> Leguminosae	fruit	diabetes mellitus, dysentery, lack of appetite	uncommon in cultivation
<i>Pongporong</i>	<i>Oroxylum indicum</i> Bignoniaceae	leaf, flower	gastritis	rare in West Java
<i>Randamidang</i>	<i>Cosmos caudatus</i> Compositae	leaf	lack of appetite	uncommon in cultivation
<i>Rane</i>	<i>Selaginella willdenowii</i> Selaginellaceae	leaf	internal injury, stomatitis (mouth ulcers)	uncommon in wild
<i>Reunden</i>	<i>Staurogyne elongata</i> Acanthaceae	young leaf	uremia (kidney failure)	uncommon in wild
<i>Salada cai</i>	<i>Rorippa nasturtium-aquaticum</i> Cruciferae	leaf	scurvy	common in wild
<i>Sampeu</i>	<i>Manihot esculenta</i> Euphorbiaceae	leaf	poor eye sight	commonly cultivated
<i>Sawi</i>	<i>Brassica chinensis</i> Cruciferae	leaf	dysentery	commonly cultivated
<i>Sintrong</i>	<i>Erechtites valerianifolia</i> Compositae	leaf	hypertension (high blood pressure)	common in wild
<i>Sorawang</i>	<i>Ocimum tenuiflorum</i> Labiatae	leaf	body odour	commonly cultivated
<i>Takokak</i>	<i>Solanum torvum</i> Solanaceae	fruit	aphrodisiac	uncommon in cultivation
<i>Terong</i>	<i>Solanum melongena</i> Solanaceae	fruit	furunculosis (a severe case of boils or inflamed sores)	commonly cultivated
<i>Wortel</i>	<i>Daucus carota</i> Umbelliferae	tuber	poor eye sight, ascariasis (round worm infection)	commonly cultivated
<i>Waluh</i>	<i>Cucurbita moschata</i> Cucurbitaceae	young leaf	ascariasis (round worm infection)	commonly cultivated

Table 2. *Lalap* (raw vegetables) which are not used as medicine.

Sundanese name	Scientific name and family		Edible portion	Distribution in Java
<i>Buncis</i>	<i>Phaseolus vulgaris</i>	Leguminosae	fruit	common in cultivation
<i>Eceng</i>	<i>Sagittaria sagittifolia</i>	Alismataceae	leaf	common in wild
<i>Genjer</i>	<i>Limnocalyx flava</i>	Alismataceae	leaf, flower	common in wild
<i>Kacar panjang</i>	<i>Vigna unguiculata</i>	Leguminosae	young leaf, fruit	common in cultivation
<i>Kemang</i>	<i>Mangifera caesia</i>	Anacardiaceae	young leaf	rare
<i>Kapri</i>	<i>Pisum sativum</i>	Leguminosae	young leaf	uncommon in cultivation
<i>Kidenok</i>	<i>Euphorbia pulcherrima</i>	Euphorbiaceae	stem, leaf	uncommon in cultivation
<i>Poh-polian</i>	<i>Pilea nelastomoides</i>	Urticaceae	leaf	common in wild
<i>Rasamala</i>	<i>Altingia excelsa</i>	Hamamelidaceae	young leaf	uncommon in wild
<i>Secin</i>	<i>Brassica</i> spp.	Cruciferae	leaf	common in cultivation
<i>Salada</i>	<i>Lactuca sativa</i>	Compositae	leaf	common in wild
<i>Tespong</i>	<i>Erechtites hieracifolia</i>	Compositae	leaf	common in wild

Table 3. Dominant *lalap* species at markets in Bogor.

Market name	Dominant species during dry season	Dominant species during wet season	Main source area for market
<i>Ps Anyar</i>	<i>Cosmos caudatus</i> <i>Pilea melastomoides</i> <i>Momordica charantia</i> <i>Manihot esculenta</i>	<i>Limncharis flava</i> <i>Rorippa nasturtium-aquaticum</i> <i>Mangifera caesia</i> <i>Parkia speciosa</i>	Ciapus, Ciampea, Salabenda
<i>Ps Bogor</i>	<i>Phaseolus vulgaris</i> <i>Daucus carota</i>	<i>Daucus carota</i> <i>Phaseolus vulgaris</i>	Cipanas
<i>Ciomas</i>	<i>Ocimum tenuiflorum</i> <i>Psophocarpus tetragonolobus</i> <i>Momordica charantia</i> <i>Pilea melastomoides</i>	<i>Limncharis flava</i> <i>Cosmos caudatus</i> <i>Sauropus androgynus</i> <i>Parkia speciosa</i>	Cileueur
<i>Kapuk</i>	<i>Ocimum tenuiflorum</i> <i>Momordica charantia</i> <i>Manihot esculenta</i>	<i>Pilea melastomoides</i> <i>Limncharis flava</i> <i>Rorippa nasturtium-aquaticum</i>	Ciapus, Salabenda
<i>Purbasari</i>	<i>Carica papaya</i> <i>Manihot esculenta</i> <i>Cucumis sativus</i>	<i>Pilea melastomoides</i> <i>Limncharis flava</i> <i>Mangifera caesia</i> <i>Parkia speciosa</i>	Cileueur, Ciapus
<i>Ramayana</i>	<i>Momordica charantia</i> <i>Ocimum tenuiflorum</i> <i>Sauropus androgynus</i> <i>Manihot esculenta</i>	<i>Pilea melastomoides</i> <i>Psophocarpus tetragonolobus</i> <i>Limncharis flava</i> <i>Parkia speciosa</i>	Ciapus, Cipanas
<i>Sukasari</i>	<i>Phaseolus vulgaris</i> <i>Daucus carota</i>	<i>Phaseolus vulgaris</i> <i>Cucumis sativus</i>	Ciapus, Cipanas

The primary reasons for this reduction in plant availability in the wild and naturalised situations are a reduction of suitable habitat due to urban developments and increased pressure on food resources in relatively recent times due to increased human population numbers.

The main reasons for the reduction of market demand for *lalap* are threefold. Firstly, technological developments have decreased the sociological importance of *lalap* knowledge. Secondly, senior Sundanese generations are not 'passing on' traditional *lalap* knowledge to younger Sundanese people. And thirdly, younger Sundanese people do not value traditional Sundanese knowledge due to relatively recent lifestyle changes in West Java.

It appears that many younger Sundanese people prefer to eat foods of a more contemporary nature, rather than the more traditional health promoting *lalap* available from markets in Bogor.

The Sundanese tradition of eating these medicinal *lalap* species is a long held tradition. Sundanese people living in smaller, more remote villages still commonly eat *lalap* and prefer it to more recently introduced foods.

It is possible that the reduction of *lalap* availability and demand outlined above could balance each other out and result in a negligible effect on the *lalap* resource. However, if the *lalap* resource reduction significantly precedes a reduction in demand, this could cause a significant shortage of *lalap* for the Sundanese people of Bogor.

ACKNOWLEDGMENTS

The Sundanese stallholders from the vegetable markets at Bogor are thanked for their participation in interviews. Their traditional knowledge of *lalap* and the medicinal qualities of the plants, and their generosity in sharing this knowledge are gratefully acknowledged.

Clyde Dunlop and Greg Leach of the Parks and Wildlife Commission of the Northern Territory provided comments on the manuscript. Lily Coates provided Figure 1.

REFERENCES

- Astuti, I.P., Munaworah, E. and Wightman, G.M. (eds). 1995. *Sundanese ethnobotany: traditional plant knowledge from Ciamis and Tasikmalaya, West Java, Indonesia* (Northern Territory Botanical Bulletin Series No. 19). Parks and Wildlife Commission of the Northern Territory: Darwin, Australia.
- Brummitt, R.K. 1992. Vascular plant families and genera. Royal Botanic Gardens: Kew, England.
- Burkill, I.H. 1966. *A dictionary of the economic products of the Malay Peninsula*. Ministry of Agriculture: Kuala Lumpur, Malaysia.
- Mabberley, D.J. 1997. *The plant-book; a portable dictionary of the vascular plants*. Cambridge University Press: Cambridge, England.
- Ochse, J.J. 1977. Vegetables of the Dutch East Indies. A. Asher & Co.: Amsterdam, The Netherlands.
- Siemonsma, J.S. and Kasem Piluck (eds). 1994. *Plant resources of South-East Asia No. 8, Vegetables*. PROSEA: Bogor, Indonesia.

Accepted 28 August 2001

The traditional use of mangroves in East Sumba, Indonesia

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ABSTRACT

The traditional names and uses of 20 mangrove plants and 12 mangrove associates from East Sumba, Indonesia, are presented. Traditional knowledge and contemporary use associated with the mangrove community in general are discussed. For the Sumbanese community, mangrove habitats are important for a number of reasons. Clearing of mangroves causes concern, as does the loss of traditional knowledge of mangroves and their uses. Mangrove destruction also affects local weather conditions and creates airborne dust and sand problems. Mangrove habitats form part of the living area for many people in Melolo.

KEYWORDS: Mangroves, traditional use, ethnobiology, East Sumba, Indonesia.

INTRODUCTION

The island of Sumba lies between the Indian Ocean and Sawu Sea in the Nusa Tenggara Timur Province in eastern Indonesia (Fig. 1). It is one of the major islands in the Lesser Sunda Islands group, along with Bali, Lombok, Sumbawa, Flores and Timor. Sumba is on the outer arc of the Lesser Sunda chain and is of non-

volcanic origin. It is relatively dry and barren compared to many other parts of eastern Indonesia.

Sumba is about 300 km long and 80 km wide, with an area of approximately 11,150 km², and a population of about 400,000 people. It is divided into an eastern and western regency, which also reflects differences in climate, vegetation, language and culture. West Sumba receives significantly more rain than East Sumba and is

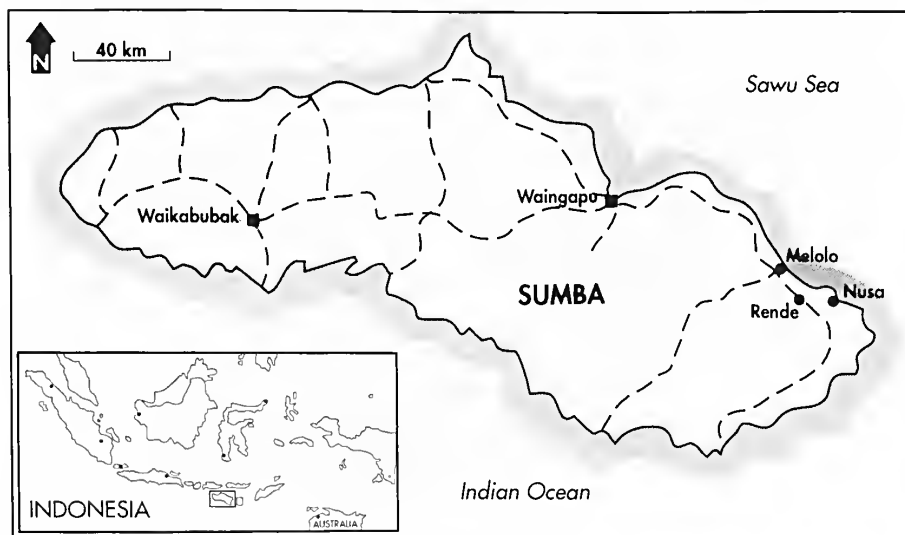


Fig. 1. Locality map for field sites on Sumba, Indonesia.



Fig. 2. Evidence of mangrove destruction at Nusa, East Sumba, Indonesia.

less rocky and mountainous; consequently it is more densely populated, culturally diverse and the vegetation is generally more dense and lush.

East Sumba is characterised by rolling treeless hills in the interior, extensive grassy lowlands and an extended dry season. Annual rainfall is between 600 and 800 mm, which mainly occurs in November to March; for the rest of the year there is little or no rain. Average daily maximum temperatures are high, above 30°C, for the majority of the year.

The population of the East Sumba regency is about 140,000 people; the capital is Waingapu. The people of East Sumba are renowned for their cultural strength and knowledge of natural surroundings. Most still follow their traditional belief system called *marapu*, and speak the traditional language *kambera*.

The mangrove habitat is referred to as *lutan bakau* in Bahasa Indonesian, in East Sumba it is called *bako*. While the traditional language of East Sumba is *kambera*, there are language influences from other parts of the Lesser Sunda group of islands. Some names recorded for mangrove plants were given as coming from Sabu (Savu) or Timor.

There is little published information relating to mangroves in East Sumba. Monk *et al.* (1997) cite some references for Nusa Tenggara Timur Province, though none relate specifically to Sumba; they list 14 species from the province. It is likely that there are more species of mangroves in East Sumba than we have recorded here.

Traditional knowledge and uses relating to mangrove communities in general. The senior Sumbanese people of Melolo consider the mangrove

habitat a valuable source of natural resources and an important habitat. They are concerned that the traditional names and uses of plants in the mangroves are not being learnt by younger generations.

They are also concerned by increased use and clearing of mangroves by the current larger populations in some village areas such as Melolo, Nusa and Waingapu. Pressure from people looking for firewood, timber for construction and medicines is particularly obvious in places (Fig. 2).

The river lined with mangroves that passes through Melolo and originates near Rende is locally referred to as *kali obat*, literally medicine river. It is a reference to the healing qualities of the water in the river, which are derived from the wood, bark, leaves, stems, flowers and fruit of mangrove plants that occur in the river. People of Melolo believe that this detritus washing around in the water gives it powerful medicinal qualities to cure skin rashes and disorders. Anyone suffering skin disorders takes a bath in the river to treat the disorder.

Mangrove forests are an important source of firewood for the people of East Sumba who live near the coast. The timbers generally have a high calorific value and are consequently good firewood for cooking. In some areas of mangroves near villages there is evidence of significant felling of large trees to obtain the wood for cooking and for other purposes.

Mangrove communities are used for fishing, especially on the rising tide. Mangrove worms, *Teredo* spp., can be used to bait fishhooks. Mud crabs, *Scylla serrata*, and some shellfish are collected from mangrove areas to be eaten.

This destruction of the fringing mangrove forest and their protective effects has resulted in stronger, dry season, south-easterly winds reaching some village areas. This brings increased airborne dust and sand and increased discomfort, and has even led to some houses being unroofed and suffering other wind damage.

In Melolo, the mangrove community forms the north-east margin of the township. In fact, for many households the edge of the mangrove community forms part of their living area between the parts of the house. Some parts of the living area may be elevated on stilts above high tide in amongst the mangrove plants. Many of the daily chores that take place around the house, kitchen, bathroom and shed occur in these upper tidal zones. As a consequence the mangrove habitat and the mangrove plants form an important part of the daily lives of Sumba people living in these areas.

METHODS

Information relating to the names and uses of mangrove plants at Nusa and Melolo was collected in March 1999, during fieldwork with the senior elders considered most knowledgeable about mangrove habitats (Figs 3-4). Plants were collected and East Sumbanese elders informally interviewed about the species. Plants were also identified in the field by elders who led researchers to plants they considered important and useful.

Information about the uses of mangroves was also obtained by means of direct observation of people in mangrove habitats and people using mangrove species, primarily in the area of Nusa and around the town of Melolo.

Information that relates to plant species that are associated with mangrove communities, but not restricted to mangrove habitats is presented here together with plants traditionally regarded as 'true mangroves'. Data we collected relate to specimens that were found in mangrove communities, and considered part of that habitat by our Sumbanese mentors.

Our East Sumbanese guides and mentors were Bapak Kalejuru at Nusa and Bapak Kanaweo, Bapak Hawupahe, and Bapak Adamingus at Melolo.

Audio data were recorded using a Sony minidisc digital recorder. Written notes were made at the same time to corroborate and clarify the audio recordings. Photographic records of the plants and the data collection were also made.

Plants were identified with their scientific name as they were encountered in the field, and specimens were collected for interview purposes and for later vouchering. The identification of plant vouchers was checked to ensure correct scientific names at Herbarium Bogoriense (BO). Voucher specimen details are given on the second line of each species account and the initials IP refer to Inggit Puji Astuti, and GW to Glenn Wightman. Specimens are lodged at Herbarium Bogoriense, the Indonesian national herbarium in Bogor.



Fig. 3. Inggit Puji Astuti and Kalejuru recording traditional knowledge in mangroves at Nusa, East Sumba, Indonesia.



Fig. 4. Recording traditional knowledge of mangroves used in construction at Nusa, East Sumba, Indonesia.

RESULTS

The traditional names and uses of mangrove plants and associated plants from East Sumba are presented alphabetically by scientific name. Scientific names are based on those in use at Herbarium Bogoriense (BO) and the Northern Territory Herbarium (DNA). The local names are given in bold italics. Family names are based on those used by Mabberley (1990).

Mangrove plants

Aegialitis annulata R.Br. **Boa**
PLUMBAGINACEAE IP 240 & GW

The wood of the stems is very light and buoyant. Short pieces of timber are used to make life vests for fisherman. The timber is also used to make a float designed to keep a fishhook near the surface of the water when fishing.

Aegiceras corniculatum (L.) Blanco **Ajubiko, Biko**
MYRSINACEAE IP 241 & GW

The wood is used for making fences. The leaves are fed to goats as forage.

This plant is considered in some areas to be the same as *Lumnitzera racemosa*.

Avicennia marina (Forssk.) Vierh. **Rowmangani**
VERBENACEAE IP 242 & GW

The twigs and leaves are dried and crushed to a powder, then mixed with the powdered twigs and leaves

of *Ceriops tagal*, *biko*, and *Pemphis acidula*, *baku*. This mixture is wrapped in cloth and applied externally to a broken bone; it has the effect of speeding the healing of the bone. The area where the bone is broken must be thoroughly massaged before the poultice is applied.

The wood is used to make handles for *parang* (machete). The wood is also used for building houses and for fences.

Bruguiera exaristata Ding Hou **Ajuboa**
RHIZOPHORACEAE IP 243 & GW

The wood is used for construction purposes, mainly for building houses.

Bruguiera parviflora Wight & Arn. **Laru**
RHIZOPHORACEAE IP 244 & GW

The wood is used for construction purposes, mainly for building houses. It is considered to be the male form of *Rhizophora* spp., which is considered to be female.

Ceriops decandra (Griff.) Ding Hou **Bago**
RHIZOPHORACEAE IP 247 & GW

The hypocotyl that has fallen from the parent tree and is just beginning to establish roots may be used as a float for a fishing line. The lower half of the fleshy, buoyant hypocotyl is tied to the fishing line, near the hook, where it floats and keeps the hook near the surface of the water.

Ceriops tagal (Perr.) C.B.Robinson **Biko**
RHIZOPHORACEAE IP 248 & GW

The wood from larger trunks may be used for building purposes or for firewood. The stems of small, straight saplings are used to make racks for drying small fish.

The red inner bark is chipped off into small pieces, and boiled in water for 5 minutes. The liquid and bark chips may then be thrown into an area of water to stun fish. The fish can then be easily collected and prepared for eating. This 'fish poison' may be used in salt or freshwater areas.

The red inner bark is also used to obtain a red dye. This is used for any purpose requiring a red colour, but is most famously used to produce the red colour for *ikat* cloth, though the roots of *Morinda citrifolia* are used in preference. The area of East Sumba is recognised throughout Indonesia as being a producer of the highest quality *ikat* cloth.

The twigs and leaves are used medicinally (refer to *Avicennia marina* above, for details of use).

Derris trifoliata Lour. **name uncertain**
LEGUMINOSAE IP 253 & GW

No uses were recorded for this species; although it is widely used as a fish poison in areas to the west and south-east of Sumba.

Dolichandrone spathacea (L.f.) Schumann **Kelebodoka**
BIGNONIACEAE IP 254 & GW

This plant has special mystical powers for the people of East Sumba. The old fruit are used in a ceremony to stop rain. The fruit are produced during the wet season from December to March, and the old weathered fruit are available during March and April at the end of the rainy season.

Excoecaria agallocha L. **Kabutou**
EUPHORBIACEAE IP 255 & GW

The white sap is considered to be very dangerous and must be avoided. If the sap enters the eye it causes blindness and if it touches the skin it causes itching and a rash. It has a very bitter unpleasant taste.

Hibiscus tiliaceus L. **Dauu warung**
MALVACEAE IP 258 & GW

The bark can be stripped off in long lengths that are quite strong. It is sun dried and then plaited into a rope that is used to tie up animals and for other purposes where string is required.

The young leaves are pounded up, and rubbed onto the abdomen of pregnant ladies to make childbirth easy.

The young leaves are crushed together with coconut that has been sun dried and then burnt. This mixture is then rubbed into the scalp of the freshly shaved head of children to promote the growth of thick, black hair.

Biko (Sumba), *Ajubiko* (Sabu)
Lumnitzera racemosa Willd.
COMBRETACEAE IP 259 & GW

The red inner bark is chipped off into small pieces and boiled in water for 5 minutes. The liquid and bark chips may then be thrown into an area of water to stun fish. The fish can then be easily collected and prepared for eating. This 'fish poison' may be used in salt or freshwater areas.

The timber is considered to be good firewood.

The leaves are pounded with onion, and this mixture is applied as a compress to treat tired muscles. It is especially effective to treat back pain or an aching lower back resulting from hard physical work.

Pemphis acidula J. R. Forst et G. Forst. **Baku**
LYTHRACEAE IP 261 & GW

The very hard and strong timber is used to make wooden nails to hammer through planks of timber to attach them to the frame of the hull of a *perahu* (small traditional sailing boat).

The twigs and leaves are used medicinally, refer to *Avicennia marina* for details of use.

Rhizophora apiculata Blume **Biko**
RHIZOPHORACEAE IP 264 & GW

The wood is used for constructing houses. The bark may be used as red dye for *ikat* cloth, especially at Sabu. The bark is chipped off and pounded, then water is added. The fibre is then soaked in this liquid to make it turn red.

Rhizophora spp. are considered to be the female form of *Bruguiera parviflora*, which is considered to be male.

Rhizophora lamarkii Montrouz. **Biko**
RHIZOPHORACEAE IP 265 & GW

No uses are recorded for this species in East Sumba.

Rhizophora stylosa Griff. **Biko**
RHIZOPHORACEAE IP 266 & GW

The long narrow aerial roots are used in the construction of the roof of traditional houses. Large quantities of *Hyperata cylindrica*, *alaug-alaug*, are tied along the length of the root to form thick grassy shingles. These are laid overlapping each other to form the traditional thatched roof of houses in East Sumba.

Sonneratia alba Sm. in B. Rees **Boa, Pamuhu**
SONNERATIACEAE IP 267 & GW

Branches are broken off and taken to feed the leaves to goats as forage. The wood is used for construction purposes.

Thespesia populnea (L.) Soland. ex Correa **Mbudi**
MALVACEAE IP 268 & GW

The timber is used to make paddles for *perahu* or canoes.

Thespesia populneoides (Roxb.) Kostel. **Wahudahi**
MALVACEAE IP 269 & GW

The leaves are pounded and water added; this is rubbed onto the abdomen of a pregnant woman to make childbirth easier.

The inner bark may be stripped off and sun dried, then made into rope.

Jeruuiuauga
Xylocarpus moluccensis (Lam.) M. Roem.
MELIACEAE IP 272 & GW

The timber from large straight trees is used to make planks to construct the hulls of *perahu*. The timber has a very attractive grain and is considered the best available in East Sumba for making *perahu*.

The leaves are added to bath water when having a wash as it makes the person having the bath feel very fresh.

Mangrove associates

Calotropis gigantea (L.) R.Br. **Kolerara**
ASCLEPIADACEAE IP 245 & GW

The stems are cut and dried in the sun, and the fibre of the inner bark is plaited to make a fine rope for fishing lines or fish nets.

name uncertain
Casuarina equisetifolia Forster & Forster f.
CASUARINACEAE IP 246 & GW

The wood is used for building houses and for firewood. In recent times small plants have also been used as Christmas trees by Sumbanese followers of the Christian faith.

Cordia subcordata Lam. **Aeua**
BORAGINACEAE IP 249 & GW

The timber is used for making the hull of a *perahu*. The timber is also used to make a torch for fishing at night. The wood is cut into short segments, tied together, and one end is lit to provide the light to go fishing. The wood is used for building and for carving statues.

Cyperus sp. **Hiha**
CYPERACEAE IP 251 & GW

The fibrous stems are pounded and the stringy fibre used to tie corn cobs into bundles ready to carry.

Deudrobium affine Steudel **Dodilai**
ORCHIDACEAE IP 252 & GW

The green sticky juice scraped from the pseudobulbs is rubbed into the tassels at the ends of *ikat* cloth to prevent them from fraying and to give them a smooth finish.

Fimbristylis sp. **Hiha**
CYPERACEAE IP 256 & GW

The fibrous stems are pounded and the stringy fibre used to tie corn cobs into bundles ready to carry.

Guetarda speciosa L. **Bolarroe**
RUBIACEAE IP 257 & GW

The wood is used for making the hull of a *perahu*, boat or canoe. The leaves are used to wrap small bundles of food. It is also used to hold lime powder while it is burnt.

Lysiphyllum binatum (Blanco) De Wit **Ruketpahu**
LEGUMINOSAE IP 260 & GW

The leaves are boiled in water and the liquid used as an external wash to treat skin disorders, especially blistering. The boiled leaves may also be made into a compress and applied to the abdomen to treat a woman after childbirth. This compress can also be used to treat a headache by holding it on the forehead.

Pongamia pinnata (L.) Pierre **Ajuai**
LEGUMINOSAE IP 262 & GW

The bark is pounded then water is added and the mixture used as pig feed. The leaves are wrapped around unripe fruit to make it ripen quickly. The sap from this plant is very hot and itchy if it touches the skin.

Dabobo (Sumba), **Dauukukukuda** (Sabu)
Premna seratifolia L.
VERBENACEAE IP 263 & GW

This plant is used as a treatment for the mothers of newborn babies. A few young leaves may be eaten raw daily by the mother for one week after childbirth to ensure a full recovery. Alternatively, the young leaves may be boiled in water and the liquid drunk. The liquid becomes red like tea, and sugar may be added for sweetening. The leaves may also be heated and applied daily for one week as a poultice to the abdomen, hips and upper thighs of the new mother. This also ensures a quick and full recovery from childbirth.

The small, dark fruit are eaten when they are ripe, mainly by children. The black fruit are very sweet. The leaves are boiled in water and the cooled liquid used as an external wash to treat asthma.

The name from Sabu, *Dauukukukuda*, literally means 'the leaf shaped like the foot of a horse'.

Tinospora smilacina Benth.
MENISPERMACEAE

The thick and flexible stems are used as rope to pull or tie up a canoe. The leaves, together with onion and garlic, are boiled and then crushed to a fine liquid. Some of this is drunk and some is rubbed onto the abdomen to cure stomachache.

Ximenia americana L.
OLACACEAE

The fruit can be eaten when they turn red and are fully ripe. They have a sweet and sour taste and are favoured by children. However, plants grown in cultivation have sweeter tasting flesh.

ACKNOWLEDGMENTS

Our Sumba guides and mentors were Kalejuru at Nusa and Kanaweo, Hawupahe and Adamingus at

Loromanubou
IP 270 & GW

Bidaralaut
IP 271 & GW

Melolo. Pak Oktovianus was our very competent driver and guide in Melolo, Nusa and Waingapu. Greg Leach and Bill Freeland, of the Parks and Wildlife Commission of the Northern Territory, provided useful comments on a draft of this paper. Lily Coates provided Figure 1.

The Australian Centre for International Agricultural Research provided funding for useful tree assessment work we were undertaking at Luku Melolo in East Sumba. This research led to the production of this paper. Particularly, we thank Heather Crompton for her support and encouragement.

SELECTED REFERENCES

- Mabberley, D.J. 1990. *The plant-book; a portable dictionary of the higher plants*. Cambridge University Press: Cambridge, England.
- Monk, K.A., et al. 1997. *The Ecology of Nusa Tenggara and Maluku*. The Ecology of Indonesia Series vol. 5. Periplus Editions, Hong Kong.

Accepted 28 August 2001

Alimentary canal anatomy and diet of the nurseryfish, *Kurtus gulliveri* (Perciformes: Kurtidae), from the Northern Territory of Australia

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ABSTRACT

The alimentary canal and diet of nurseryfish, *Kurtus gulliveri*, are described based on 50 specimens (average size 223 mm SL) collected from the Adelaide River, near Darwin, Northern Territory, during April-July 2001. The mouth is large, angled at about 45°, and opens terminally and slightly superiorly. Small conical teeth are present in bands on the premaxillary and dentary and in patches on the palatine and basibranchials. The gill rakers are long and flat with small teeth at their distal ends. The stomach is very muscular and capable of sizable distension. There are 8-11 pyloric caeca at the junction of the stomach and intestine. The intestine is relatively short, and the anus is located much more anteriorly than in most fishes. Sixty percent of the stomachs and 64% of the intestines contained food items, whereas 84% of the entire gastrointestinal tracts contained prey. Twenty-four percent of the stomachs were full or distended. Arthropods (prawns, isopods, insect larvae) and teleosts are the most frequently ingested prey.

KEYWORDS: *Kurtus gulliveri*, nurseryfish, diet, anatomy, isopods, prawns, alimentary canal, gastrointestinal tract, stomach, intestine.

INTRODUCTION

Kurtus gulliveri Castelnau, 1878, is found in turbid, tidal rivers of coastal northern Australia and southern New Guinea (Berra 2001). This unusual-looking, hatchet-shaped, hump-headed fish is very compressed with a long anal fin and a narrow caudal peduncle (Fig. 1). It is remarkable for its unique mode of parental care whereby the males carry the eggs on a hook on their head (Weber 1910: fig. 2), hence the common name, nurseryfish. Very little is known about the basic biology of this species. Previously published literature on nurseryfish diet and anatomy is sparse. Roberts (1978) reported that most nurseryfish examined from the Fly River of Papua New Guinea had empty stomachs, and a few had eaten small fishes. Guide books (Lake 1971; Merrick and Schmida 1984; Allen 1989, 1991; Larson and Martin 1990) mention that nurseryfish are carnivorous and consume fishes and crustaceans but provide no further details. De Beaufort (1914) described some aspects of the skeleton and soft anatomy.

A study to learn more details of nurseryfish life history was begun on the Adelaide River, near Darwin, Northern Territory, in early 2001. The results reported here are part of that study. The Adelaide River, named for the British dowager queen by L. R. Fitzmaurice of H.M.S. *Beagle* in 1839, originates in the hills south of Darwin. It meanders with dramatic wet season (December-April) increases in volume into Adam Bay, an inlet of the Timor Sea on Clarence Strait, 51 km north-east of Darwin. It is tidal for 121 km and navigable for 130 km of its 180 km length (Messel *et al.* 1979). There are two high and low tides each day with a tidal variation as much as 7 m in the lower reaches. A downstream constriction of the river known as the "Narrows" creates a bottleneck to the passage of outgoing water as the tide recedes. This prevents the previous tide from draining completely before the following tide invades the river. The time between high and low water (approximately 6-7 hours) is not sufficient to drain the river to the low tide level before the tide rises again. As a result the maximum tidal variation in the vicinity of Marrakai

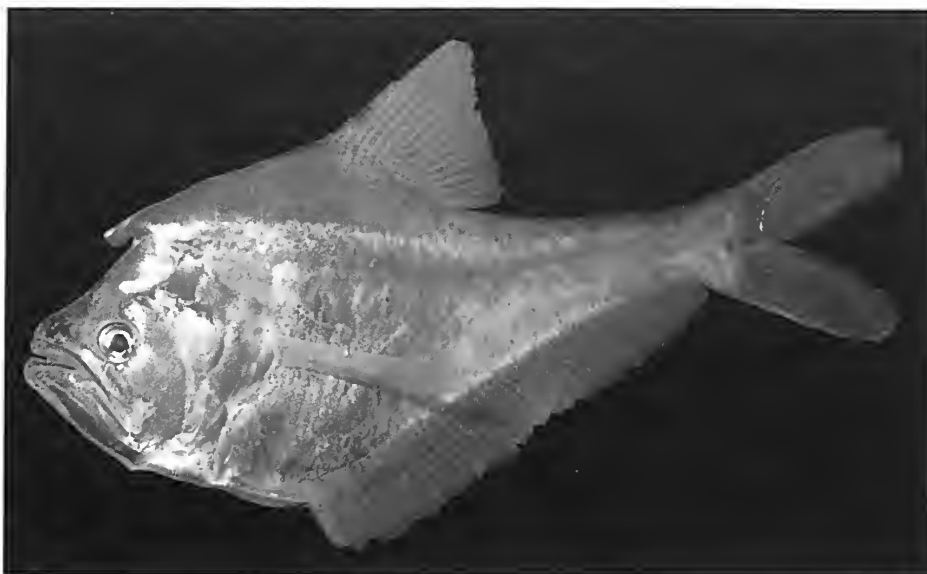


Fig. 1. Male *Kurtus gulliveri* photographed live in a 5,000 litre aquarium at the Territory Wildlife Park.

Creek is about 4 m. The water is turbid for much of the year. River banks are mud with mangroves and sedges. Lower tributaries are "saltwater creeks" up to 19.5 km from Adam Bay. "Freshwater creeks" begin at about 31.6 km from the mouth (Messel *et al.* 1979).

METHODS

Nurseryfish were collected with an 11 cm mesh gill net (2.5 m deep x 15 m long) from the Adelaide River (mouth = 12°13.4'S 131°13.5'E) from 18 April through 16 July in water ranging from brackish to fresh (28-0 ppt). The net was set during daylight hours in the middle of major, mangrove-lined tributaries such as brackish water "Number 2 Creek", also known as "C Creek", at river km 8.0 (12°16.9'S 131°21.8'E, upstream from the "Narrows") and the fresh water Marrakai Creek at river km 82.1 (12°42'S 131°19.7'E, upstream from the Arnhem Highway bridge). Messel *et al.* (1979: fig. 3.2, p. 13) provided a map of the river and a description of ecological conditions. The net was checked every 20 minutes for 2-3 hrs. The net could only safely and effectively be worked for approximately 2 hrs before high tide to ½ hr after high tide and again about 3-4 hrs after the turn of the tide due to the strong tidal movement and the inability of the net to hold the bottom. A cast net was employed to sample fish along shallow mud banks. Additionally, nine nurseryfish were collected by seine from ponds of a commercial barramundi farm along the Adelaide River flood plain near Middle Point.

Large fish were placed on ice immediately. The gastrointestinal (GI) tracts were removed in the

laboratory several hours later and preserved in 10% formalin. Small fish were preserved in formalin immediately upon capture. Fifty GI tracts from fish ranging in size from 105 mm standard length (SL) to 290 mm SL (average SL = 223 mm) were dissected. The contents of the stomachs and intestines were examined separately under a binocular microscope. Stomach fullness was recorded on the following scale; 0 = empty, 0.5 = trace, 1 = one-quarter full, 2 = one-half full, 3 = three-quarters full, 4 = full, 5 = distended (Fig. 2) (Berra *et al.* 1987). Individual prey items were counted, measured, and identified to the lowest taxonomic level that the state of digestion allowed using Bruce (1983),



Fig. 2. Stomach of a 221 mm SL nurseryfish distended with the paelaemonid prawn, *Macrobrachium equidens*.

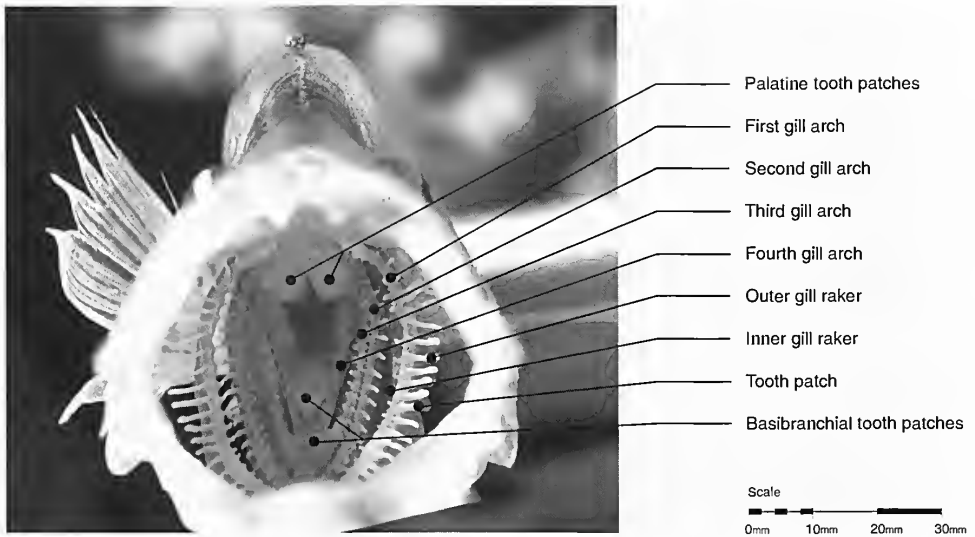


Fig. 3. Pharyngeal cavity of female nurseryfish showing outer and inner gill rakers, and palatine and basibranchial tooth patches.

Dore and Frimodt (1987), Grey *et al.* (1983), and Jones and Morgan (1994).

RESULTS

Anatomy. The mouth of nurseryfish is large, terminal and directed slightly superiorly at approximately a 45° angle (Fig. 1). The elongate premaxilla lies over the toothless maxilla, and its anterior edge is studded with a band of small, conical teeth. There is a diastema on the upper jaw between the left and right premaxillae. Left and right anterior projections of the palatine also have clusters of small conical teeth (Fig. 3). The dentary is toothed along its anterior surface, and the width of the tooth rows decreases sharply about mid-way posteriorly. Teeth of both the upper and lower jaws can be seen and felt when the mouth is closed. The lateral edge of the first gill arch has 21-22 long, thin, flattened gill rakers (Fig. 3). The upperside of the arch and the inside of the gill rakers are covered with tiny teeth. There are 18 stubby projections (inner gill rakers) on the medial surface of the first arch that fit into the spaces between the gill rakers of the second arch (Fig. 3). There are 18 paddle-like gill rakers on the second arch. These are shorter and broader than those of the first arch. The second gill arch has about 12 club-shaped inner gill rakers that fit into the approximately 16 outer gill rakers on the third arch which has 10 club-like inside projections. The fourth arch has about 10 stubby gill rakers. Small conical teeth are present in two paired patches on the pharyngeal surfaces of the basibranchials at the junction of the third gill arches and behind the fourth gill arches, respectively (Fig. 3). The anterior

tooth patch is small and triangular, and the posterior patch is elongate with larger teeth.

The oesophagus leads into a very thick-walled stomach lined with rugae that allow for substantial distension (Fig. 2). The small intestine joins the stomach along its ventral surface. There are 8-11 pyloric caeca that radiate from the junction of the stomach and small intestine (Fig. 4). These finger-like projections are embedded in intestinal fat stored in the surrounding mesenteries and are difficult to see. The transparent gall bladder lies on the right, anterior side of the pyloric caecal mass, adjacent to the large liver. The relatively short intestine continues posteriorly and ventrally

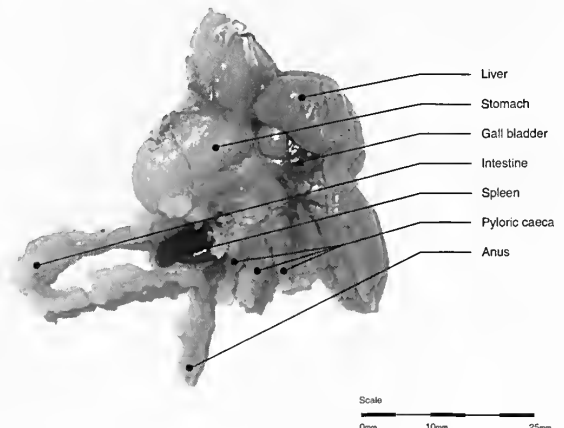


Fig. 4. Nurseryfish gastrointestinal tract from stomach to anus as viewed from the right side. The head of the fish is to the right. Fat deposits have been partially removed for clarity, and the intestine has been dissected free from mesenteries and displaced slightly posteriorly to show its length.

exiting the body anterior to the gonads. The viscera are crowded anterodorsally into a triangular body cavity rather than extending posteriorly and horizontally into an elongate coelom typical of most perciform fishes. The anus of nurseryfish is located in front of the anal fin and between the left and right ventral fins, far more anteriorly than in most fishes.

Diet. Of the 50 nurseryfish dissected, 60% had food items in the stomach and 64% had food in the intestine (Table 1). Twenty-four percent of the stomachs were full or distended with food. Forty-two GI tracts (84%) had prey items either in the stomach, intestine or both. Principal food items were arthropods and teleosts (Table 2). The largest stomach contents were prawn pieces that measured 53, 45, 35, and 30 mm. Food items measuring 20–53 mm made up 27% of the sample, and items 6–19 mm composed 53%. The remaining stomach contents (20%) consisted of food fragments from 0.1–5 mm.

Nurseryfish maintained in a 5000 litre aquarium at the Territory Wildlife Park (south of Darwin) were fed a "cloud" of hundreds of live prawns (*Caridina longirostris*, *Macrobrachium* sp.) collected from nearby wetlands. This produced an "alert" reaction in the normally placid, hovering nurseryfish school. As the prawns dispersed, the nurseryfish swam rapidly through the path of their target and opened their cavernous mouth near the prey items. The prey was engulfed by the forward motion of the fish and presumably by the vacuum action of the large mouth's expansion. Feeding behaviour was observed by both of us and other staff of the Territory Wildlife Park on several occasions.

DISCUSSION

The enormous mouth of nurseryfish suggests that they engulf prey. This was confirmed by our feeding observations. The fine dentition on the jaws and in the oral cavity is well adapted to holding prey items such

Table 1. Fullness of stomachs and intestines of 50 *Kurtus gulliveri* (105–290 mm SL) collected in the Adelaide River from April–July 2001. 0=empty, 0.5=trace, 1=1/4 full, 2=1/2 full, 3=3/4 full, 4= full, 5= distended (after Berra *et al.* 1987).

Fullness (0–5)	Stomach		Intestine	
	No.	%	No.	%
0	20	40	18	36
0.5	8	16	11	22
1	5	10	6	12
2	5	10	10	20
3	0	0	3	6
4	5	10	1	2
5	7	14	1	2

Table 2. Number and percent occurrence of food items in the diet of *Kurtus gulliveri* from the Adelaide River, N.T. based on 42 specimens with food in their gastrointestinal tract.

Taxa	No.	% Occurrence
Phylum Arthropoda		
Class Malacostraca		
Order Decapoda		
Prawn fragments	24	57.1
Crab larvae	1	2.4
Order Isopoda		
<i>Alitropus typus</i>	4	9.5
Class Insecta		
Insect fragments	7	16.7
Phylum Chordata		
Teleostei		
Fish fragments	10	23.8
Organic matrix	12	28.6
Mangrove leaf	1	2.4

as small arthropods and fishes. Processing by the tooth patches on the palatine and basibranchials may explain why most food items like prawns and fishes were found as fragments even though they were ingested whole. This volumetric reduction would facilitate digestion in the rather small body cavity. Additionally, the long, thin, toothed gill rakers form an efficient screen to retain prey of the size eaten by nurseryfish.

Prawn fragments were the most common item in the diet and were represented in 57% of the specimens (Table 2). Aside from *Macrobrachium equidens* (Fig. 2), species identification was not possible due to the finely divided nature of the carapace fragments. Posterior portions of prawn rostra and their size distribution suggest that, in addition to the Paelae-monidac, species of the families Penaeidae and Atyidae are also eaten. All three prawn families occur in the shallow waters along the mangrove-covered mud banks of the study area. The organic matrix (Table 2), which was found only in the intestines, is identical in texture and consistency to the gut contents of prawns collected from the Adelaide River. Its presence in nurseryfish is probably due to digestion of prawns and consequent release of their gut contents. Ingestion of a mangrove leaf was most likely incidental to foraging on prawns along the mud banks.

A single crab larval (zoea) fragment was found, but it was too small to identify. Our field observations show that the isopod *Alitropus typus* (Aegidae) is common on the surface and gills of barramundi (*Lates calcarifer*) and other fishes taken from the Adelaide River, including nurseryfish. They were found in the stomach or intestine of nearly 10% of the nurseryfish. Insects, represented by pieces of compound eyes and partial

mouthparts, constituted a major dietary category for seven of the nine nurseryfish from the barramundi ponds. Insects were not found in the GI tracts of fishes from the Adelaide River. This is possibly due to the fact that the grassy banks around the ponds provided habitat for insect larvae, unlike the river banks which are covered twice each day at high tide. At least one odonate (dragonfly) and one coleopteran (beetle) larval fragment were recognisable, however further identification was not possible.

Fish fragments including scales, fin rays, vertebrae, and small pieces of muscle were found in nearly 24% of the specimens (Table 2). In one case, a large piece of fish torso (26 mm), including portions of the spinal column, distended the stomach. The presence of a dorsal fin spine attached to this mass suggests a perciform fish.

In addition to the ubiquitous *Crocodylus porosus*, which often swam over our nets, some predatory species taken with nurseryfish in our gill nets included *Carcharinus leucas*, an undescribed species of *Glyptis*, *Pristis microdon*, and *Lates calcarifer*. However, examination of the gut contents of 15 *L. calcarifer* from about 40-60 cm SL revealed no identifiable nurseryfish remains.

ACKNOWLEDGMENTS

During this project the first author was Research Associate at the Museum and Art Gallery of the Northern Territory. This research was supported by small grants from the National Geographic Society (No. 6895-00), the Columbus (Ohio) Zoo, and Bioscience Productions Inc. to TMB. The Department of Primary Industry and Fisheries of the Northern Territory, Graham White and Quentin Allsop assisted with fieldwork. Max O'Brien scanned 35 mm colour slides into the computer, made black and white prints, and labelled the illustrations. Francisco J. Neira critiqued a draft of this manuscript, Niel L. Bruce identified whole specimens of isopods from the Adelaide River, and John W. Short identified the *Macrobrachium equidens* in Fig. 2. We are very grateful to these individuals and institutions for their support.

REFERENCES

- Allen, G. R. 1989. *Freshwater fishes of Australia*. TFH Publications: Neptune City, New Jersey.
- Allen, G. R. 1991. *Field guide to the freshwater fishes of New Guinea*. Christensen Research Institute Publication 9: Madang, Papua New Guinea.
- Beaufort, L. F. de 1914. Die anatomie und systematische stellung de genus *Kurtus* Bloch. *Gegenbaurs Morphologisches Jahrbuch* 48: 391-410.
- Berra, T. M. 2001. *Freshwater fish distribution*. Academic Press: San Diego, California.
- Berra, T. M., Campbell, A. and Jackson, P. D. 1987. Diet of the Australian grayling, *Prototroctes maraena* Gunther (Salmoniformes: Prototroctidae), with notes on the occurrence of a trematode parasite and black peritoneum. *Australian Journal of Marine and Freshwater Research* 38: 661-669.
- Bruce, N. L. 1983. Aegidac (Isopoda: Crustacea) from Australia with descriptions of three new species. *Journal of Natural History* 17: 757-788.
- Castelnau, F. de 1878. Australian fishes. New or little known species. *Proceedings of the Linnean Society of New South Wales*, 2: 225-248.
- Dore, I. and Frimodt, C. 1987. *An illustrated guide to shrimp of the world*. Osprey Books and Scandinavian Fishing Year Books: Huntington, New York and Hedehusene, Denmark.
- Grey, D. L., Dall, W. and Baker, A. 1983. *A guide to the Australian penaeid prawns*. Northern Territory Government Printing Office: Darwin.
- Jones, D. and Morgan, G. 1994. *A field guide to crustaceans of Australian waters*. Reed: Sydney.
- Lake, J. S. 1971. *Freshwater fishes and rivers of Australia*. Nelson: Melbourne.
- Larson, H. K. and Martin, K. C. 1990. *Freshwater fishes of the Northern Territory*. Northern Territory Museum Handbook Series No. 1: Darwin.
- Merrick, J. R. and Schmida, G. E. 1984. *Australian freshwater fishes*. J. R. Merrick: Sydney.
- Messel, H., Gans, C., Wells, A. G. and Green, W. J. 1979. *The Adelaide, Daly and Moyle Rivers. Surveys of tidal river systems in the Northern Territory of Australia and their crocodile populations*. Monograph No. 3. Pergamon Press: Sydney.
- Roberts, T. F. 1978. An ichthyological survey of the Fly River in Papua New Guinea with descriptions of new species. *Smithsonian Contribution to Zoology* No. 281.
- Weber, M. 1910. A new case of parental care among fishes. *Koninklijke Akademie van Wetenschappen te Amsterdam* 13: 583-587.

Accepted 8 October 2001

A new genus of small gobiid fish (Teleostei, Gobiidae) from the Indo-west Pacific, with description of two new species

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ABSTRACT

A new genus, *Tryssogobius*, is created for two new species of Indo-west Pacific gobiids (*T. colini* n. sp. and *T. longipes* n. sp.). The two species are distinguished by differences in fin rays counts, oculoscapular pores, body shape, and coloration. Both species are small, less than 30 mm SL, and occur in relatively deep coral reef habitats, where they hover above the substrate in a manner reminiscent of the microdesmid *Nemateleotris*.

KEYWORDS: Gobiidae, new genus, new species, *Tryssogobius colini*, *Tryssogobius longipes*.

INTRODUCTION

In 1986, Pat Colin sent the senior author a small collection of colour slides and gobiid fishes from Motupore Island, Papua New Guinea, to identify. Among the fishes were three specimens which bore little resemblance to any described genus, having enlarged interorbital scales, scales on the preopercles, opercles and branchiostegal rays, and no preopercular pores. A search among other "mystery" goby material from other institutions revealed additional specimens, and the realisation that the specimens comprised two species. Most specimens were from relatively deep water (27-82 m). One of the new species, small but elegant in form and colouring, has appeared in diving magazines and popular books (e.g. Kuitert 1992; Suzuki and Senou 1996; Okamura and Amaoka 1997). Other coral reef goby genera with scaled preopercles and opercles include *Exyrias* and *Macrodonotogobius*. However, these relatively large gobies have three to four rows of scales on the preopercle, subterminal mouths, preopercular pores and the rear portion of the oculoscapular canal is present over the opercle.

It is not unusual to find new species or even new genera among gobiid fishes, as it has been estimated that there may be over 2,000 species among the Gobioidae (Hocutt 1993). Many of the new taxa are from deeper water, or from infrequently-sampled localities or habitats. Unfortunately, given the state of taxonomy

today, it may take up to 90 years to describe the taxa we know of today, to say nothing of those yet to be discovered (Hocutt 1986).

Abbreviations used are: AMS: Australian Museum, Sydney; BPBM, Bishop Museum Honolulu; KPM, Kanagawa Prefectural Museum of Natural History, Odawara; NTM, Museum and Art Gallery of the Northern Territory, Darwin; OMNH, Osaka Museum of Natural History, Osaka; USNM, National Museum of Natural History, Washington, D.C.; WAM, Western Australian Museum, Perth; SL: standard length in mm; HL, head length in mm; TRB: transverse scale count backward from anal fin origin.

SYSTEMATICS

Family Gobiidae Subfamily Gobiinae *Tryssogobius* new genus

Type species. *Tryssogobius colini* new species, by original designation.

Diagnosis. Head and body scaled (Fig. 1); branchiostegal membranes scaled in one species. Predorsal with cycloid scales, increasing in size anteriorly, reaching forward to eyes; anteriormost scale slightly smaller than eye, extending above middle of eye. Operculum covered with 2-4 large cycloid scales. Cheek with large cycloid scales; scales under eye embedded. Gill opening extends

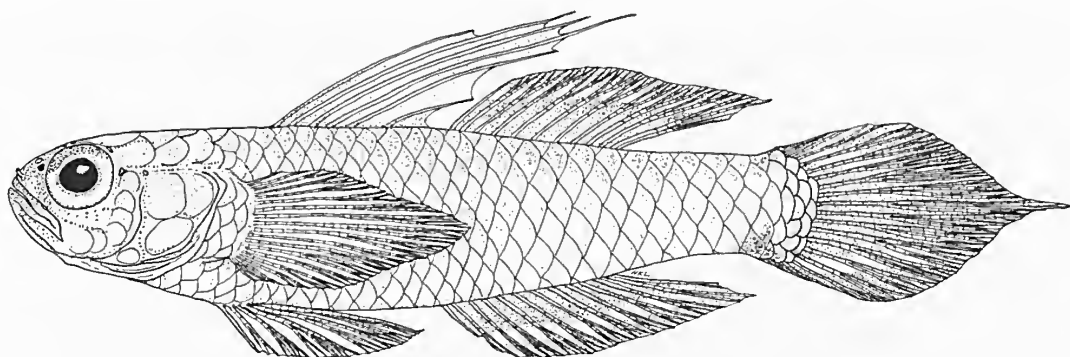


Fig. 1. Holotype of *Tryssogobius colini* n. g., n. sp., NTM S.12561-001, 29 mm SL male.

forward to below opercle or to posterior preoperculum margin. Isthmus broad and covered with medium sized scales. Pelvic fins fused, forming a cup-shaped disc, reaching to below anus or further back. Median interorbital pores closely spaced, placed just before anteriormost predorsal scale; occasionally pores fused together. Jaws short and very oblique.

Osteology. Information from two specimens of *T. colini* n. sp., one cleared and double-stained 18 mm SL male (ex NTM S.13169-003) and a damaged specimen (only anterior half present, ex BPBM 29281). Five branchiostegal rays. No mesopterygoid; metapterygoid narrow, splint-like, not contacting quadrate; symplectic moderately broad, with no processes reaching toward preopercle; pterygoid narrow; palatine short, reaching about halfway down pterygoid; premaxilla with tall ascending and articular processes. Lachrymal bone expanded, oval. Rostral cartilage large, unossified. Frontals large, supraoccipital small, with short pointed crest. Four pectoral radials, fully ossified in one specimen, only central portions ossified in other. Scapula an unossified strip, foramen small. Baudelot's ligament extending from base of anterior fork of cleithrum to exoccipital. Urohyal rectangular, double-pointed posteriorly. Vertebrae 10+16. Dorsal pterygiophore formula 3-22110. Two anal pterygiophores before first haemal spine. First epineural articulating with rear of parahypophysis. Caudal with 7/6 or 7/7 procurent rays; one epural; fused hypurals 1-2 articulating with centrum. Gill rakers ossified, spiny. Five branchiostegal rays.

Sensory papillae. Based upon *T. colini*. Head papillae reduced in number (Fig. 2). Short line of more or less round papillae below eye, extending to infraorbital pore. Short upper longitudinal line behind eye on mid-preoperculum, and short vertical line with 2-3 papillae immediately below anterior part of upper longitudinal line. Below anterior margin of eye, 3-5 large round papillae. Long lower longitudinal line from lower jaw to near rear edge of preoperculum. Distinct longitudinal line from infraorbital pore to above end of operculum, line interrupted above middle of operculum by short

transverse line. Prominent transverse line from just before terminal lateral canal head pore, running along anterior part of operculum. Short line dorsoposteriorly on operculum and second short line anteroventrally on preoperculum. Preopercular mandibular series composed of inner row composed of close-set papillae and outer row composed of very wide-set papillae; a gap of no papillae behind posterior end of jaws in outer or both rows. Top of head with 2-3 papillae adjacent to postorbital pore. Short line from medial side of postorbital pore extending onto nape to above operculum on each side. Snout with 2 pairs of papillae near tip.

Remarks. Few goby genera have scaled cheeks and opercles as well as transverse papillae, such as the coral reef genera *Asterropteryx* and *Macrodontogobius*. The monotypic *Macrodontogobius wilburi* differs from *Tryssogobius* in having a disjunct oculoscapular canal present over the preopercle and opercle, a subterminal mouth, and usually possessing a large recurved canine tooth at side of dentary. It has scales which extend from the isthmus over the ventralmost part of the branchiostegal membranes; a different arrangement to that found in *Tryssogobius colini*. *Asterropteryx* always has 1-8 distinct spines on the posterior margin of the preopercle, distinct transverse rows under the eye, and, depending on species, the pelvic fins are separate or fused, with or without a frenum present. *Exyrias*, also found on coral reefs, has scaled cheeks and opercles, but has longitudinally arranged sensory papillae and an oculoscapular canal present over preopercle and opercle (disjunct). A number of other gobiine genera have scaled cheeks and opercles, but differ by an array of characters (e.g. longitudinal papillae patterns, hard pungent first dorsal fin spines in some species, differences in oculoscapular canal and preopercular pore arrangements in all species).

Although *Tryssogobius* looks and behaves rather like a tiny *Nemateleotris*, and has been previously identified as a *Ptereleotris* (Burgess *et al.* 1988), it does not appear to be related to these fishes, which are usually placed in the family Microdesmidae. Hoese (1984) proposed the

Microdesmidae as separate from the Gobiidae, while acknowledging that the group shared some derived osteological features with gobiids. Birdsong *et al.* (1988) placed *Nemateleotris* in a phenetic group (the Parioglossus group) with *Oxymetopon* and *Parioglossus*, and kept *Ptereleotris* separate because of its 3-32010 dorsal fin formula. Thacker (2000) placed *Nemateleotris* and other taxa in a separate family, Ptereleotridae, as these taxa did not fit within her redefinition of the Microdesmidae. However, Akihito *et al.*'s (2000) cytochrome *b* study shows the microdesmids *Ptereleotris* and *Gummellichthys* together forming a separate cluster from the gobiids *Acanthogobius*, *Periophthalmus*, *Taenioides* and *Tridentiger*.

Nemateleotris, *Oxymetopon* and *Parioglossus* share the dorsal pterygiophore formulae of 3-22110, 26 vertebrae, 1 epural and 1 pre-anal pterygiophore, as well as having a 2-1 ratio of dorsal and anal fin elements to vertebrae. *Nemateleotris* has 27-32 second dorsal and anal fin rays, 110-160 lateral scales, no scales on the head, separate pelvic fins and a fleshy median predorsal ridge. *Tryssogobius* has 9-11 second dorsal and anal fin rays, 24-26 lateral scales, a fully scaled head, 2 anal pterygiophores before the first haemal spine, and the pelvic fins fused with frenum present (unlike *Nemateleotris*, *Oxymetopon* and *Parioglossus*). The relationships of Birdsong *et al.*'s Parioglossus group to other gobiids is not yet clearly established.

Other than stating that it is a gobiine, it is not possible to place *Tryssogobius* in a phylogenetic position, given the confused state of gobiid relationships at present.

Etymology. The generic name is from the Greek *tryssos*, meaning dainty or delicate, and *gobius*, a goby. The gender is masculine.

Tryssogobius colini new species

(Figs 1-6, Table 1)

Ptereleotris sp. - Burgess *et al.* 1988: 561, pl. 476.

Tiny dart-goby - Kuiter 1992: 217, fig. C.

Gobiidae sp. 1 - Masuda and Kobayashi 1994: 374, fig. 3.

Moegilhaze - Suzuki and Senou 1996: 1.

Gobiidae, gen. & sp. 2 - Okamura and Amaoka 1997: 624.

Undetermined genus and species - Myers 1999: 264, pl. 1651.

Gobiidae sp. 2 - Akihito *et al.* 2000a: 1250, 1306.

Type material. HOLOTYPE - NTM S.12561-001, 29 mm SL, Loloata Island, near Port Moresby, Papua New Guinea, coll. P. Colin, September 1986, 27 m (Fig. 1). PARATYPES - NTM S.12561-002, 20 mm SL, and AMS I.38428-001, 24 mm SL, taken with holotype; WAM P.27826-[ex006], 1(21), 3 km S of aerodrome, Negros Island, Manus Island, Papua New Guinea, coll. G. Allen and R. Knight, 6 October 1982, 35-41 m;

BPBM 32504, 1(23.5), sand and rubble slope, N end of Madang, Papua New Guinea, J. Randall, 2 November 1987, 40 m; BPBM 36936, 2(19-21), rubble slope, "Pohle's Reef", off Normanby Island, D'Entrecasteaux Islands, Papua New Guinea, R. Pyle and J. Earle, 8 December 1995, 82 m; BPBM 29281, 4(21-24 mm SL; plus one missing posterior half of body, no data taken), Augulpelu Reef, Belau (Palau Islands), coll. Bruce Carlson, June-July 1983, 55-67 m; NTM S.13169-003, 6(17-21), Unjulran Reef, Maumere Bay, Flores, Indonesia, coll. B. Russell, 5 November 1991; BPBM 34063, 1(26), near wreck of Japanese warship, E of Maumere Bay, Flores, Indonesia, coll. J. Randall, 11 September 1988, 30 m; BPBM 34220, 1(24.5), silty sand and rubble, lagoon side of Karang Elmoos Reef, Halmahera, coll. J. Randall, 13 October 1989, 55 m; BPBM 37676, 1(19), sloping sand channel in drop-off, W side of Augulpelu Reef, Palau, coll. J. Randall, 9 May 1997, 31 m; BPBM 37696, 1(21), on shelf flanked by numerous small caves, W side Augulpelu Reef, Palau, coll. J.L. Earle, 10 May 1997, 90 m; KPM-NI004151, 1(24), Mabul Island, near Semporna, Sabah, Malaysia, coll. Y. Hirata, 1995-1996; OMNH P-8100, 1(24), Funaura, Iriomote-jima, Okinawa Prefecture, coll. K. Yano, 1996, 55 m.

Additional material examined (non-type material). BPBM 37245, 2(24-28), hovering above bottom near *Nemateleotris decora*, along protected wall on lagoon side, short drop-off, Augulpelu Reef, Palau, coll. B. Carlson, 20 May 1991, 47 m [fish in poor condition, one broken in two]; USNM 316195, 1(23), Maribago, Maclan, Cebu, Philippines, coll. C. Ferraris, 2 August 1979, 3-5 m.

Description. Based on 23 specimens 16.5-32.5 mm SL (Table 1). Counts for holotype indicated by asterisk.

First dorsal spines VI* (23); second dorsal rays I, 9 (1), 1, 10* (22); anal rays I, 11* (23); pectoral rays 16 (1), 18 (10), 19* (11), 20 (1); segmented caudal rays

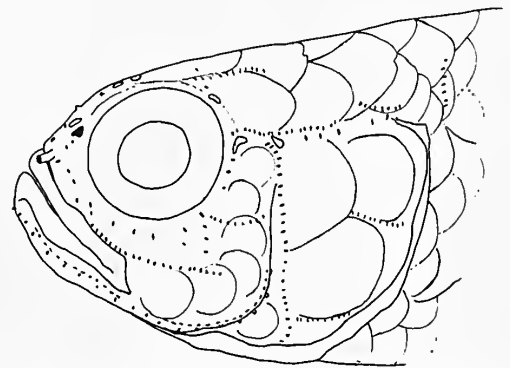


Fig. 2. Head of holotype of *Tryssogobius colini* n. g., n. sp., showing head pores and sensory papillae.

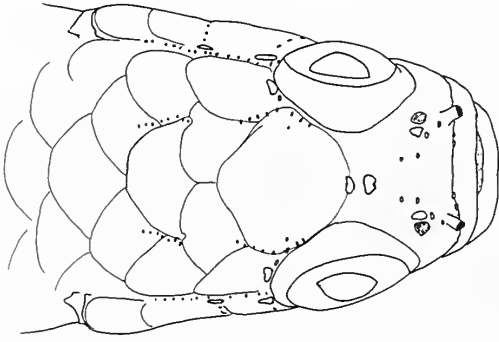


Fig. 3. Top view of head of holotype of *Tryssogobius colini* n. g., n. sp., showing head pores, papillae and predorsal scales.

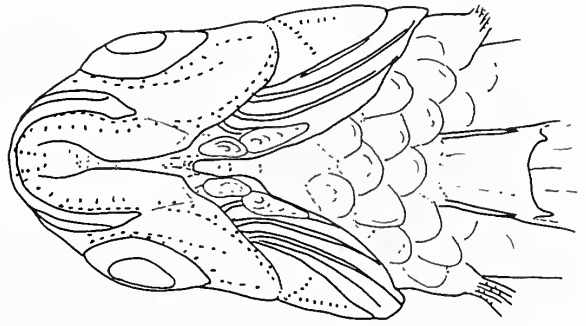


Fig. 4. Ventral view of head of holotype of *Tryssogobius colini* n. g., n. sp., showing scales on branchiostegal membranes.

17* (23); branched caudal rays 6/6 (1), 7/6* (10), 7/7 (12); longitudinal scale count 24 (4), 25* (13), 26 (5); transverse scales (TRB) 7 (13), 8* (9); predorsal scale count 6* (17), 7 (3); gill rakers on outer face of first arch 3+12 (1), 4+13 (2), 4+14 (1), 5+12 (1); rakers

elongate, longest raker approximately equal to length filament length; rakers on outer face of second arch 2+1+9 (1), 2+1+10 (1); rakers on inner face of first and other arches short and denticulate; vertebrae 10+16 (1).

Table 1. Summary of counts and measurements of *Tryssogobius colini* n. g., n. sp. (n = 23).

	Mean	Maximum	Minimum	Mode
First dorsal	6	6	6	6
Second dorsal	10	10	9	10
Anal	11	11	11	11
Pect. right	19	20	16	19
Pect. left	18	20	17	18
Caudal segmented	17	17	17	17
Caudal branched	14	14	12	14
Long. scales	25	26	24	25
Tr. scales back	7	8	7	7
Tr. scales forward	8	9	8	8
Predorsal scales	6	7	6	6
Caud. ped. scales	12	12	11	12
SL	22.0	32.5	16.5	21.0
Head length	6.2	8.6	4.6	5.1
Head depth	4.0	5.7	3.1	3.6
Head width	3.9	5.1	3.0	3.4
Body depth	4.6	6.6	3.0	4.0
Body width	2.6	3.9	1.7	2.4
Caud. ped. leng.	4.7	6.8	3.3	4.8
Caud. ped. dept.	2.7	4.0	2.0	2.5
Snout length	1.3	1.8	1.0	1.2
Eye width	2.3	3.2	1.6	2.3
Upper jaw	2.3	3.5	1.6	2.0
Interorbital	1.3	2.0	1.0	1.1
Pect. length	5.9	8.8	3.9	6.7
Pelv. length	5.8	9.0	4.0	4.8
Caud. length	6.6	10.5	4.5	5.8
Depressed D1	8.5	18.7	4.8	6.6

Head pores large (Figs 2,3). Posterior nasal pore immediately medial to posterior nostril, separated from nostril by thin membrane; unpaired median anterior and posterior interorbital pores close together between middle of eyes; postorbital pore behind each eye; infraorbital pore below postorbital and terminal oculoscapular canal pore above each posterior end of preoperculum. No preopercular pores.

Head more or less square in cross-section, about as wide as deep at posterior preopercular margin, length 3.3-4.0 in SL, depth at posterior preopercular margin 1.3-1.8 in HL, width at posterior preopercular margin 1.4-1.8 in HL. Mouth very oblique, forming an angle of about 50-60° with body axis; anterior margin of jaws in line with middle of eye; posterior end of jaws under anterior margin of pupil. Upper jaw length 2.3-3.2 in HL. Anterior nostril at end of short tube just above upper lip; posterior nostril in contact with anterior margin of eye. Eye large, width 2.4-3.2 in HL. Interorbital broad, about equal to pupil diameter, width 3.8-6.1 in HL. Snout short, broadly rounded in dorsal view, strongly convex in side view, much less than eye length, length 4.3-6.0 in HL. Tongue tip truncate or with slightly rounded margin. Teeth small, conical and slightly curved. Outer row of teeth in upper jaw slightly enlarged and wide-set, followed by inner row of smaller close-set teeth; outer row of teeth in lower jaw composed of wide-set teeth confined to anterior end of jaw, inner row of smaller close-set teeth extending full length of dentary. No vomerine teeth. Vomer protrudes into mouth in some specimens. Posterior half of interorbital covered by part of anteriormost predorsal scale. Operculum with 3 large and 1-2 smaller scales covering whole of operculum; cheek scales large, in single row around posterior and ventral margin of eye; pectoral base covered with 7 or 8

cycloid scales; prepelvic area covered with cycloid scales. Isthmus broad, covered partly by branchiostegal membranes; membrane on each side with 2 elongate cycloid scales (Fig. 4). Body depth at anal origin 4.3-5.6 in SL. Caudal peduncle depth 7.6-9.1 in SL. Caudal peduncle length 4.3-5.8 in SL.

First dorsal fin elevated, tips of second to third dorsal spines filamentous (fourth spine occasionally filamentous), in males, fin reaching back from between middle of second dorsal fin and middle of caudal peduncle (females with high fin, sometimes with filamentous spines, second to fourth spine reaching beyond others, when fin depressed, reaching only to above anterior half of second dorsal fin), depressed first dorsal length 2.0-4.2 in SL in male, 1.7-3.7 in SL in female; last dorsal spine widely separate from preceding spines; first dorsal fin base short, dorsal fins separated by 2 rows of scales (by distance about a quarter to half base of first dorsal fin). Posterior dorsal and anal rays elongate, reaching to beyond base of caudal fin in male, short posterior rays in female barely reaching caudal fin base or to only above caudal peduncle. Pectoral fin with rounded margin, 3.5-4.9 in SL. Pelvic origin below pectoral insertion; 3.0-6.0 in SL; pelvies pointed, fifth rays longest, fin reaching to anus or beyond. Caudal fin pointed, with triangular posterior margin, a single short filament often extending from 9th segmented ray from top, caudal length 2.8-3.8 in SL.

Male genital papilla small, slender, tapering to pointed tip; female genital papilla short, rounded or conical, no lobes at tip. Papilla in both sexes sometimes concealed in groove behind anus and partly overlapped by scales.

Live coloration (Fig. 5). Based on slides of fish from Loloata Island, New Guinea (type locality). Head and body pale pearly grey-white, darkening dorsally to greenish grey, overlain by iridescent light yellowish green. Dull whitish stripe extends from rear of eye posteriorly to upper caudal fin base, separating darker back from rest of body (stripe may be partly internal; cannot be verified from slides). Iridescent yellowish green on top of head, anterior portion of lips, and scattered in front of and below eye. Several small iridescent pale blue and violet spots on opercle, preopercle, and pectoral base. Peritoneum whitish, visible through body wall.

Upper half of iris iridescent greenish gold, lower half of iris very light gold. Pale iridescent blue green mark curves over top half of pupil. First dorsal translucent greenish yellow, with narrow violet line along each dorsal spine. First dorsal spine with orange spot at base, and light orange area halfway along spine, and another light orange spot at tip. Lower two-thirds of second dorsal light greenish yellow, outer third of fin light bluish violet, with thin stripe of pale pink through centre of bluish violet region, pink stripe narrowing posteriorly.

Anal fin (mostly concealed in slides) with pale blue margin. Caudal fin pale greyish yellow in centre, with bluish violet area above and below centre; bluish violet areas extend from upper and lower caudal base back towards centre of caudal margin, but not meeting at margin. Pale pinkish stripe present within blue-violet areas, a continuation of stripe on second dorsal; pinkish stripe runs from caudal base to rear margin of caudal. Pectorals transparent. Pelvies white.

Coloration in alcohol. Colour pattern indistinct in some specimens, depending upon collection and preservation history. Head and body yellowish to light brown. Snout, interorbital and suborbital darker than rest of head and body. In some specimens, narrow dusky-bordered white stripe from rear of eye above opercle along upper half of body, becoming quite diffuse and indistinct below gap between dorsals. A diffuse black spot ventrally at posterior end of caudal peduncle in some specimens. First dorsal fin grey. Second dorsal fin grey to brownish with submarginal longitudinal transparent stripe, bordered by thin black line; submarginal stripe sometimes placed close to median of fin. Anal fin grey to brownish basally, followed distally by thin black stripe, followed below by thin translucent stripe, fin grey to brownish on distal one-quarter. Pectoral and pelvic fins translucent, rays dusky. Caudal fin light brownish, with white oblique stripe from anterodorsal margin of caudal fin and similar stripe from anteroventral margin of fin, two stripes converging slightly, but not meeting posteriorly; this pattern indistinct in some specimens.

Distribution. Currently the species is known from Papua New Guinea, Indonesia, Sabah, Philippines, Palau, and the Yaeyama Islands of southern Japan. All specimens were taken from depths of 27 to at least 82 m and the species is undoubtedly more widespread.

Comparisons. Can be distinguished from the only other species in the genus by fin ray counts and colour pattern (see under *T. longipes* n. sp.).

Remarks. Of the type material, only the specimens from Loloata, Papua New Guinea, are in very good condition. The Palau specimens appear faded and do not show the ventral spot on the caudal peduncle. The pelvic interspinous membrane is visible only in one of those specimens and it is clearly torn.

There is some colour variation in living specimens (Figs 5,6), but it is unclear whether this represents separate species or regional differences. Images of *Tryssogobius* from Bali (Kuitert, unpubl.) and Kimbe Bay, New Guinea (Fig. 6; and Glenn Barrall, unpubl.) show fish with the first dorsal fin more strongly marked with a brighter yellow and darker blue than in the Loloata Island specimens. The second dorsal fin has a proximal band of yellow (instead of yellow to yellow-green spots) and the outer two-thirds of the fin is blue with a narrow stripe of yellow through it (instead of

being bluish-violet with pink to yellowish stripe). The caudal fin is mostly blue, yellow centrally, with two oblique yellow stripes from upper and lower edges of fin base. The eye is bluish to greenish yellow, with a bright to pale blue mark curving over the top of the pupil. The overall impression is of a blue-eyed form of *T. colini* with more strongly marked fins. No specimens of these photographed fish were available.

The specimens illustrated (living and freshly dead) in Senou and Suzuki (1996) and Masuda and Kobayashi (1994) also show some differences in colour. The caudal fin has lines of yellow spots within a pale yellowish central area, a yellow spot is present at the base of each dorsal spine and ray, and a series of yellow spots extends along the rear margin of the second dorsal fin. A vivid green stripe extends from the snout tip along the dorsal midline of the body to the caudal base. An iridescent bluish white mark along the lower margin of the eye is visible in the live fish but is absent when dead (not discernible in the preserved specimen). Additionally, the first dorsal fin of the only available Japanese specimen (OMNH P-8100), from Iriomote-jima, is the tallest of all the specimens examined. And Akihito *et al.*'s Fig. 38-4 (2000a: 1306) shows differences in papillae pattern between the holotype and the Okinawa specimen. The latter shows fewer papillae in the transverse rows under the eye, and a gap in the vertical row on the opercle.

Suzuki and Senou (1996) named the Japanese form *moegihaze* or grass-green goby, as it has been often mentioned in popular diving magazines. They describe numbers of these gobies living at Funaura, Iriomotejima, at 35 m depth over sand and mud. The fish hovered horizontally a few centimetres over their "nesting holes".

Etymology. Named for Dr Patrick Colin, who collected the holotype and other material.

***Tryssogobius longipes* new species**
(Figs 7-9, Table 2)

Type material. HOLOTYPE - BPBM 36682, 16.5 mm SL male, Indonesia, Flores, Maumere Bay, E end of Sao Wisata Resort, mud slope with isolated rock, 19.5 m, coll. J. Randall, 9 November 1990. PARATYPES - BPBM 37828, 2(16-18), same data as holotype; BPBM 37014, 2(15-17.5). Papua New Guinea, Milne Bay Province, Waga Waga, near wreck of *Muscotta*, mud, 27 m, coll. J.L. Earle, 16 December 1995; NTM S. 14630-001, 1(16.5), same data as previous; AMS I.38888-001, 1(16), same data as previous.

Additional non-type material examined. BPBM 37016, 3(20-21 mm SL), Papua New Guinea, Milne Bay Province, Waga Waga, near wreck of *Muscotta*, mud, 27 m, coll. J.L. Earle, 16 December 1995.

Description. Based on 7 specimens 15-18 mm SL (Table 2). Counts for holotype (Fig. 7) indicated by asterisk.

First dorsal VI* (7); second dorsal I,11* (7); anal I,13 (6), holotype with 14 segmented rays and no spine; pectoral 16 (3), 17* (3), one specimen with 14 rays on right side, 16 on left; segmented caudal rays 17* (7); branched caudal rays 7/6* (6); longitudinal scale count 27 (4), 28* (3); transverse scales (TRB) 7(4), 8* (3); predorsal scale count 5 (1), 6* (6); gill rakers on outer face of first arch 4+10* (1), 3+11 (1), 2+10 (1); rakers elongate, longest raker approximately equal to length filament length; rakers on outer face of second arch and rakers on inner face of first and other arches short, stubby and finely denticulate.

Head pores large. Posterior nasal pore immediately medial to posterior nostril, separated from nostril by thin membrane; median posterior interorbital pores usually fused together between middle of eyes, no anterior interorbital pores, replaced by sensory papillae; postorbital pore behind each eye; infraorbital pore below postorbital (Fig. 8). No posterior oculoscapular canal or pore above preoperculum. No preopercular pores.

Head and body compressed; head deeper than wide, length 3.7-4.4 in SL, depth at posterior preopercular margin 1.3-1.6 in HL, width at posterior preopercular margin 1.6-2.0 in HL. Mouth very oblique, forming an angle of about 60-70° with body axis; anterior margin of jaws in line with centre to upper part of eye; posterior end of jaws just below anterior margin of pupil. Upper jaw length 2.1-2.4 in HL. Anterior nostril at end of short tube just above upper lip; posterior nostril in contact with anterior margin of eye. Eye large, width 2.4-2.9 in HL. Interorbital moderate to broad, about equal to or slightly less than pupil diameter, width 4.9-6.3 in HL. Snout short, blunt in dorsal view, strongly convex in side view, much less than eye length, length 4.9-6.3 in HL. Tongue tip truncate or with slightly rounded margin. Teeth small, conical, pointed and slightly curved. Outer row of teeth in upper jaw slightly enlarged and wide-set, followed by inner row of smaller teeth; outer row of teeth in lower jaw composed of wide-set teeth confined to anterior end of jaw, inner row of smaller close-set teeth extending full length of dentary. No vomerine teeth. Vomer may protrude into mouth. Posterior half of interorbital covered by part of anteriormost predorsal scale. Operculum with 2 or 3 large scales covering whole of operculum; cheek scales large, with 3 or 4 scales in single row around posterior and ventral margin of eye; pectoral base covered with cycloid scales; prepelvic area covered with cycloid scales. Isthmus broad, covered partly by branchiostegal membranes; membrane on each side without scales. Body slender, depth at anal origin 4.4-7.7 in SL. Caudal peduncle depth 8.3-10.9 in SL. Caudal peduncle length 5.9-7.2 in SL.

First dorsal fin pointed, third and fourth dorsal spines elongate in males, fin reaching back to first few elements



Fig. 5. *Tryssogobius colini* n. g., n. sp., 27 m depth, Loloata Island, off Port Moresby. Photograph by Pat Colin.



Fig. 6. *Tryssogobius colini* n. g., n. sp., 47 m depth, at Otto's Reef, Kimbe Bay, New Britain. Photograph by Glenn Barrall.

of second dorsal fin when depressed; females with relatively lower fin without elongate spines, fin reaching back to first element of second dorsal fin when depressed; depressed dorsal length 3.4-3.9 in SL in male, 4.3-5.6 in SL in female; last dorsal spine widely separate from preceding spines, base short; dorsal fins separated by single scale. Posterior dorsal and anal rays elongate, reaching beyond base of caudal fin in male, somewhat shorter posterior rays in female reaching to procurent rays at base of caudal fin. Pectoral fin with central rays longest, 3.8-4.4 in SL. Pelvic origin below pectoral insertion; fifth ray elongate and filamentous in males, reaching back to about mid-base of anal fin; fin length 1.9-2.3 in SL in males, 4.1-5.0 in females. Caudal fin elongate, with triangular posterior margin, caudal length 2.8-3.3 in SL.

Male genital papilla small, conical and slender, unpigmented. Female genital papilla broad, rounded and smooth, with dusky tip.

Live coloration. The only live colour information is from John Earle's field notes. He stated that the living fish in BPBM 37014 were: "Translucent gray with a narrow dark-edged midlateral yellow stripe; dorsal edge of body with a very narrow dusky yellow stripe; two specimens with a black spot in the first dorsal fin". For the non-type specimens in BPBM 37016 (Fig. 9) he noted: "Midlateral yellow stripe from eye to end of caudal fin, a yellow submarginal stripe in each caudal lobe; second dorsal fin and anal fin with a yellow submarginal stripe; an oblique iridescent blue, dusky edged, dash-like mark adjacent to ventroposterior edge of eye with a broad yellow border below it; upper edge of iris iridescent blue".

Coloration in alcohol. Head and body pale greyish, with top of head and upper quarter of body paler in some specimens. Side of body with diffuse, dusky-bordered whitish band extending from behind pectoral base to caudal fin base. Lower half of head whitish. Snout and

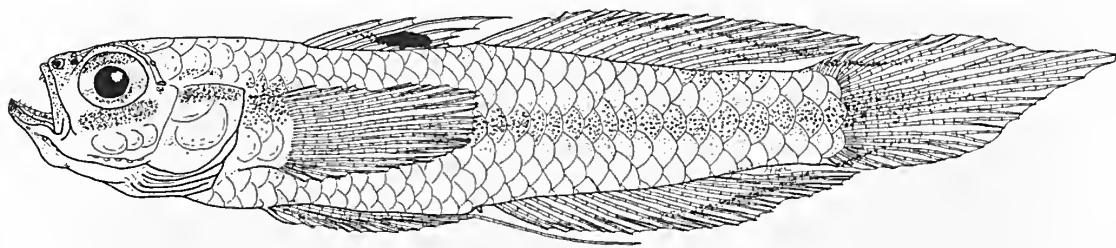


Fig. 7. Holotype of *Tryssogobius longipes* n. sp., BPBM 36682, 16.5 mm SL male.

dorsal surface of head just behind eyes plain greyish, with short white streak on dorsal midline behind posterior interorbital pore. Broad pale to dark grey stripe along lower and rear margin of eye (most intense just below eye), extending obliquely across upper part of opercle, ending as diffuse dark grey bar or dusky-bordered white bar on upper pectoral base; head stripe broken as it crosses preopercular margin. Lips and chin dusky grey. Underside of head and breast whitish.

Fins generally dusky grey to whitish. In males, first dorsal fin with broad dense black irregularly-shaped band across lower centre of fin; females with diffuse blackish band, which may be difficult to distinguish from rest of pigment, in same area. Second dorsal fin in male with narrow dark brownish line just above fin base, fin almost white proximal to dark line. Anal fin light brownish with diffuse dusky line across lower third of fin. Caudal fin greyish to brownish, with dark grey to brown oblique stripe from anterodorsal margin of fin, similar stripe extending from anteroventral margin; both stripes narrowing and converging toward rear of fin, becoming obscure before reaching pointed tip of fin; in males, area between dark stripes darker than rest of fin. Pectoral fin translucent, rays dusky brown. Pelvics whitish to faintly dusky.

Distribution. Currently the species is known only from Indonesia (Flores) and Papua New Guinea (Milne Bay). Specimens were taken from depths to 27 m and the species may be more widespread.

Comparisons. Can be most easily distinguished from *T. colini* by fin ray counts, no anterior interorbital pores, lacking scales on branchiostegal membranes, and colour pattern. *Tryssogobius colini* has I,10 second dorsal and I,11 anal fin rays (versus I,11 second dorsal and I,13 anal fin rays in *T. longipes*). *Tryssogobius colini* is pale blue-grey with a whitish lateral stripe, light blue to violet spots on the side of the head and no dark fin markings (*T. longipes* is grey with a yellow to orange lateral stripe, which may form a dark spot under the eye, and has a black spot in the first dorsal fin). Additionally, *T. longipes* has a shorter caudal peduncle (4.3-5.8 in SL in *T. colini* versus 5.9-7.2 in SL in *T. longipes*).

Remarks. The three specimens in BPBM 37016 are similar in coloration to *T. longipes* but the blackish diagonal stripe across the head is restricted to the lower rear edge of the eye (Fig. 9). Additionally, they have fin ray counts resembling *T. colini*, but all three specimens have only five first dorsal fin spines. The depressed first dorsal fin is longer, and one has a deformed second dorsal fin. The fish are not in good condition, with most scales lost. John Earle's notes on live colour indicate that, when live, the fish were coloured similarly to *T. longipes*; he did not refer to the male having the black area on the first dorsal fin. Additional specimens are required to confirm their status.

Etymology. From the Latin, *longus*, and *pes*, foot; in reference to the elongate pelvic fins, especially developed in males.

ACKNOWLEDGMENTS

Many thanks to Pat Colin, who first brought our attention to these elegant fishes and provided colour slides; to Jack Randall, who sent additional specimens, slides and information; to Glenn Barrall, for the use of his slides; to Hiroshi Senou, for facilitating the loan of specimens from Iriomotejima and Malaysia; and to the Northern Territory Government Interpreter and Translator Service.

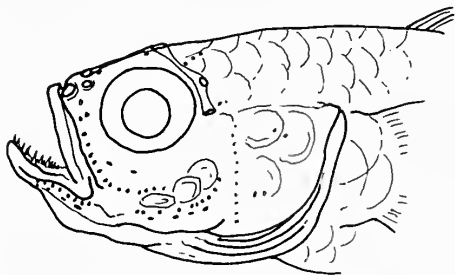


Fig. 8. Head of holotype of *Tryssogobius longipes* n. sp., showing head pores and papillae.



Fig. 9. *Tryssogobius longipes* n. sp., BPBM 37016, non-type specimen, Milne Bay. Specimens in this lot differ from the types (see text). Photograph by Jack Randall.

Table 2. Counts and measurements of *Tryssogobius longipes* n. sp.

	BPBM 36682	BPBM 36682 Holotype	BPBM 36682	NTM S.14630-001	BPBM 37014	AMS I.38888-001	BPBM 37014
First dorsal	6	6	6	6	6	6	6
Second dorsal	11	11	11	11	11	11	11
Anal	13	14	13	13	13	13	13
Pect. right	16	17	17	16	17	14	16
Pect. left	17	17	18	16	12	16	16
Caudal seg.	17	17	17	17	17	17	17
Caudal br.	13	13	13	13	13	13	-
Long.scales	27	28	28	27	27	27	28
TRB	8	8	7	8	7	7	7
TRF	9	10	9	8	9	8	8
Pred.scales	6	6	6	6	6	6	5
Caud.ped.sc.	11	12	11	9	10	11	-
SL	18.0	16.5	16.0	16.5	17.5	16.0	15.0
Head length	4.7	4.2	4.0	4.4	4.4	4.3	3.4
Head depth	3.3	3.2	2.8	2.9	2.8	2.7	-
Head width	2.6	2.7	2.5	2.3	2.2	2.5	-
Body depth	3.2	3.1	3.2	3.0	2.5	3.1	3.4
Body width	1.8	1.6	1.5	1.4	1.3	1.3	1.3
Caud. pd. leng.	3.0	2.8	2.3	2.3	2.5	2.4	2.5
Caud. pd. dept.	2.3	2.0	1.8	1.8	1.6	1.7	1.5
Snout length	0.9	0.7	0.8	0.8	0.7	0.7	0.7
Eye width	1.8	1.5	1.4	1.6	1.8	1.5	1.4
Upper jaw	2.2	1.8	1.7	1.9	1.8	1.8	1.6
Interorbital	0.9	0.8	0.8	0.8	0.7	0.7	0.7
Pect. length	4.7	3.8	3.7	4.0	4.0	3.6	3.4
Pelv. length	9.6	8.8	3.9	7.5	3.5	3.2	6.5
Caud. length	5.5	6.0	5.5	5.7	5.3	5.3	-
Dep. D1	5.3	4.3	3.4	4.3	3.1	3.7	3.8

REFERENCES

- Akihito, Sakamoto, K., Ikeda, Y. and Iwata, A. 2000a. In: Nakabo, T. (ed.) *Fishes of Japan with pictorial keys to the species. Second edition*. Tokai University Press, Tokyo.
- Akihito, Iwata, A., Kobayashi, T., Ikeo, K., Imanishi, T., Ono, H., Umehara, Y., Hamamatsu, C., Sugiyama, K., Ikeda, Y., Sakamoto, K., Fumihito, A., Ohno, S. and Gojobori, T. 2000b. Evolutionary aspects of gobioid fishes based upon a phylogenetic analysis of mitochondrial cytochrome *b* genes. *Gene* **259**: 5-15.
- Birdsong, R.S., Murdy, E.O. and Pezold, F.L. 1988. A study of the vertebral column and median fin osteology in gobioid fishes with comments on gobioid relationships. *Bulletin of Marine Science* **42**(2): 174-214.
- Burgess, W.E., Axelrod, H.R. and Hunziker, R.E. 1988. *Dr. Burgess's atlas of marine aquarium fishes*. TFH Publications, Neptune City, New Jersey.
- Hoese, D.F. 1984. Gobioidae: Relationships. In: Moser, J. *et al.* (eds) *Ontogeny and systematics of fishes*. Pp. 588-591. American Society of Ichthyologists and Herpetologists Special Publication No. 1: Kansas.
- Hoese, D.F. 1986. Indo-Pacific genera of gobioid fishes. Abstract only. In: Uyeno, T., Arai, R., Taniuchi, T. and Matsuura, K. (eds) *Indo-Pacific fish biology. Proceedings of the second international conference on Indo-Pacific fishes*. P. 942. Ichthyological Society of Japan, Tokyo.
- Hoese, D.F. 1993. A review of the current state of knowledge of the classification of gobioid fishes. Abstract only. *Systematics and evolution of Indo-Pacific fishes. Program and abstracts of papers. Fourth Indo-Pacific Fish Conference, Bangkok, Thailand, 28 November - 4 December 1993*. P. 40.
- Kuiter, R.H. 1992. *Tropical reef-fishes of the western Pacific, Indonesia and adjacent waters*. PT Gramedia Pustaka Utama, Jakarta.
- Masuda, H. and Kobayashi, Y. 1994. *Grand atlas of fish life modes. Color variation in Japanese fish*. Tokai University Publishing.
- Myers, R.F. 1999. *Micronesian reef fishes. A comprehensive guide to the coral reef fishes of Micronesia. 3rd revised and expanded edition*. Coral Graphics, Barrigada, Guam.
- Okamura, O. and Amaoka, K. 1997. *Sea fishes of Japan*. Yamakei Publishers, Tokyo [in Japanese].
- Suzuki, H. and Senou, H. 1996. Fish of the month. Moegi goby (new name). *I.O.P. Diving News* **7**(6): 1. [in Japanese].
- Thacker, C. 2000. Phylogeny of the wormfishes (Teleostei: Gobioidae: Microdesmidae). *Copeia* **4**: 940-957.

Accepted 8 October 2001

Short communication

Bait-taking fireworms (Amphinomidae: Polychaeta) and other polychaetes

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Catching polychaete worms on baited hooks while fishing or luring them to take bait in an aquarium is noteworthy because it represents evidence for carrion feeding, a feeding mode relatively uncommon amongst polychaetes. Polychaetes that are able to quickly detect and actively locate carrion are true scavengers, in contrast to detritivores, which fortuitously locate and consume animal remains (Britton and Morton 1994).

One of the earliest examples of a polychaete being captured with hook and line is that of the acoetid *Polyodontes maxillosus*, a tube-dwelling worm reaching 1-2 m in length. Anglers in the Mediterranean Sea and Atlantic coasts of France and Spain have caught this species (Eisig 1887; Saint-Loup 1889; Fauvel 1923; Parenzan 1980; Pettibone 1989). Apparently, after being hooked, the worm withdraws into its tube and holds on so tenaciously that the angler's only prize is a wriggling anterior end comprising the muscular pharynx and jaws! So bizarre in appearance was this wriggling 'monster' that it baffled many well-known marine biologists who thought it could have been a type of larva or a strange enigmatic animal (Parenzan 1980).

Perhaps the best known group of scavenging polychaetes is the Onuphidae. Although many species appear to scavenge drift algae, some such as deep sea *Hyalinoecia* and the Australian beachworms (e.g., *Australonuphis* and *Hirsutonuphis*) supplement their diet with carrion (Fauchald and Jumars 1979; Paxton 1979). Species of *Australonuphis* can move some distances toward a washed up whale or sheep (Paxton 1979). Australian beachworms are collected in large numbers by professional bait collectors and anglers from east coast surf beaches. They are lured to the surface by

dragging a piece of bait over the sand and when they pop their heads out, the collector grabs the worm behind the head with a pair of pliers or fingers (Paxton 1979).

Other polychaetes that have been caught with hook and line are the eunicids *Eunice* cf. *aphroditois* (Pallas) from the Mediterranean (G. Bellan, pers. comm) and *Eunice roussaei* Quatrefages from the Atlantic Coast of Spain (J. Grall, pers. comm). Like *Polyodontes maxillosus*, these eunicids are also large, powerful, jawed polychaetes and predation upon smaller invertebrates is likely to be an important feeding mode. However, both acoetids and eunicids include species that are carnivores, omnivores and scavengers (Fauchald and Jumars 1979), so it is not possible to say with certainty whether these species regarded the bait as carrion (and were acting as scavengers) or mistook its movement for live prey (hence predators).

Another polychaete family known to take baits is the Amphinomidae, or fireworms. These are jawless worms, each with a muscular, protrusible pharynx and well-developed anterior sense organs. Although known for some time in both Australia (R. Willan, pers. comm.) and Hawaii (J.B.-B. pers. obs.), this bait-taking behaviour appears not to have been previously documented in the literature. Most amphinomids are thought to be slow-moving predators of sessile animals such as sponges, corals, hydroids and ascidians, but some species are known or suspected of being carrion feeders (Marsden 1963; Fauchald and Jumars 1979). We provide further examples below of bait taking and scavenging behaviour in the family.

Abbreviation used in this paper: NTM, Museum and Art Gallery of the Northern Territory, Darwin.

Chloeia flava (Pallas)

A specimen of the Indo-Pacific species *Chloeia flava* was captured recently on a hook baited with a piece of beef, near the mouth of the Elizabeth River near Darwin, northern Australia (Fig. 1A-B; NTM W17241). The worm ingested the baited hook, which became lodged in the anterior part of the gut and protruded ventrally at about the 11th or 12th segment. The species is also known to take baits of fish or prawns in Australia (NTM Information Leaflet No. 17). *Chloeia flava* and other species in the genus have a keeled caruncle with complexly folded margins (Kudenov 1995), which provides a large area to present the chemosensory nuchal organs. An undescribed species of *Chloeia* from Bali, Indonesia, holds this structure erect whilst foraging (Fig. 2), thus exposing the nuchal organs to water currents and perhaps allowing improved visual field. These observations support the prediction by Fauchald and Jumars (1979) that species of *Chloeia* associated with sand and mud are carrion feeders.

Eurythoe complanata (Pallas)

The widespread tropical and subtropical species *Eurythoe complanata* is common on rubble bottoms in shallow water around the coast of Australia and Hawaii (Fig. 3). Members of the genus are thought to be

primarily carrion feeders (Fauchald and Jumars 1979; Kudenov 1995). This is supported by our present observations. Specimens kept in aquaria can be conditioned to grab a piece of fish or squid tentacle held by hand (B. Paavo pers. comm.). However, the species also shows predatory tendencies, feeding on corals, molluscs and other worms at the Waikiki Aquarium, Honolulu, Hawaii (J.B.-B. pers. obs.). Gut content studies of at least 10 large-sized specimens revealed only fragments of coralline algae and coarse sand grains but no evidence of animal remains, indicating that feeding may be infrequent or that animal remains are difficult to detect in the gut contents (J.B.-B. pers. obs.). Like *Chloeia*, they also have a well-developed keeled caruncle, but the nuchal organs follow paired lateral ridges rather than a folded margin (Kudenov 1995).

Hermodice carunculata (Pallas)

The amphi-Atlantic species *Hermodice carunculata* (Fig. 4) is predatory on corals and sea anemones, but populations living on sandy bottoms may be carrion feeding scavengers (Marsden 1963). This prediction is supported by observations in the Mediterranean of individuals found attached to dead fish, either trapped in gill nets or washed up on the shore (N. Ben-Eliahu, H. Zibrowius, pers. comm.). The caruncle of *Hermodice*



Fig. 1. Specimen of *Chloeia flava* (NTM W17241) caught on a baited hook from the Elizabeth River, Darwin. A, dorsolateral view; B, ventrolateral view. Photos Tim Berra.

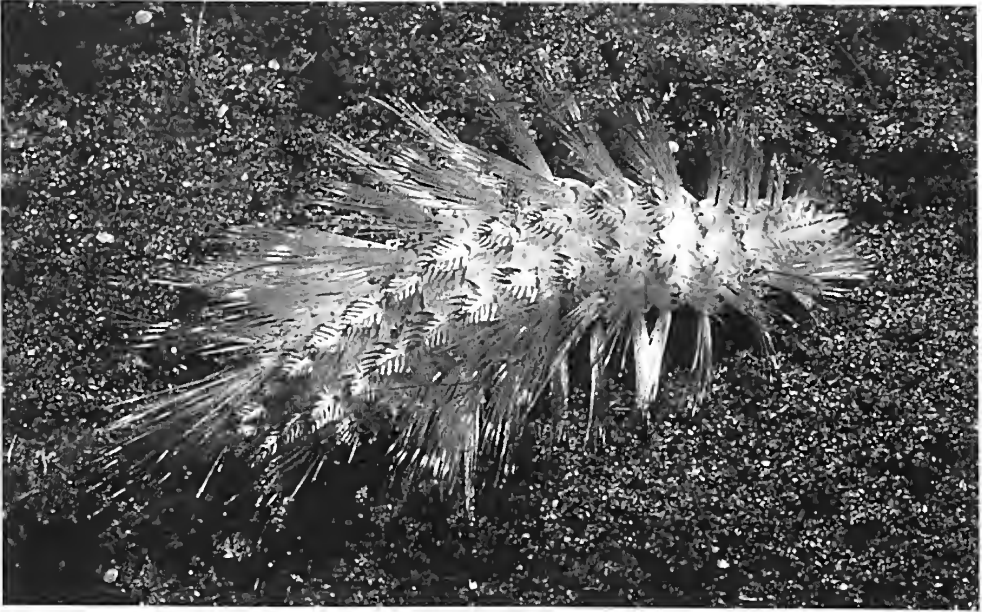


Fig. 2. *Chloeia* sp. found under a rock, Tulamben, Bali, Indonesia showing the erect caruncle on the head (right end). Specimen preserved (NTM W17191). Photo Karen Gowlett-Holmes.



Fig. 3. *Eurythoe complanata* found under a rock, east coast of Australia. Note the different colour morphs. Photo Kathy Atkinson.

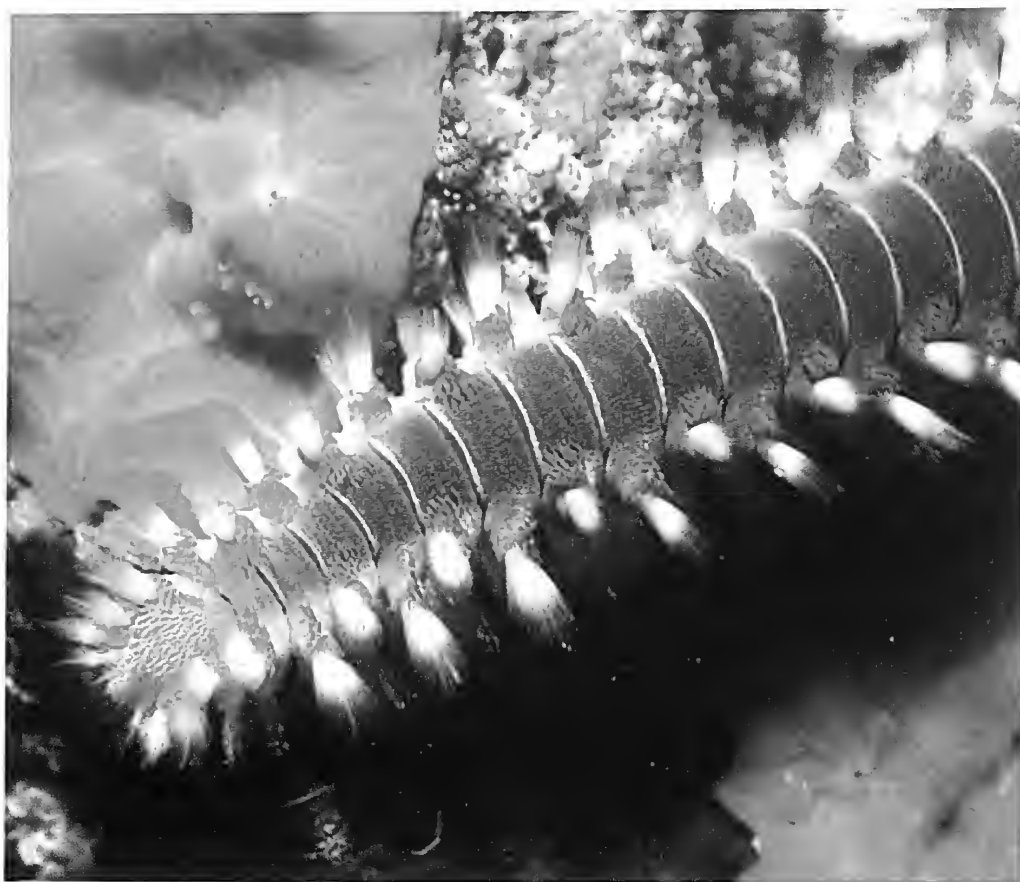


Fig. 4. *Hermodice carunculata* in its natural habitat, Malta, Mediterranean Sea. Photo David George.

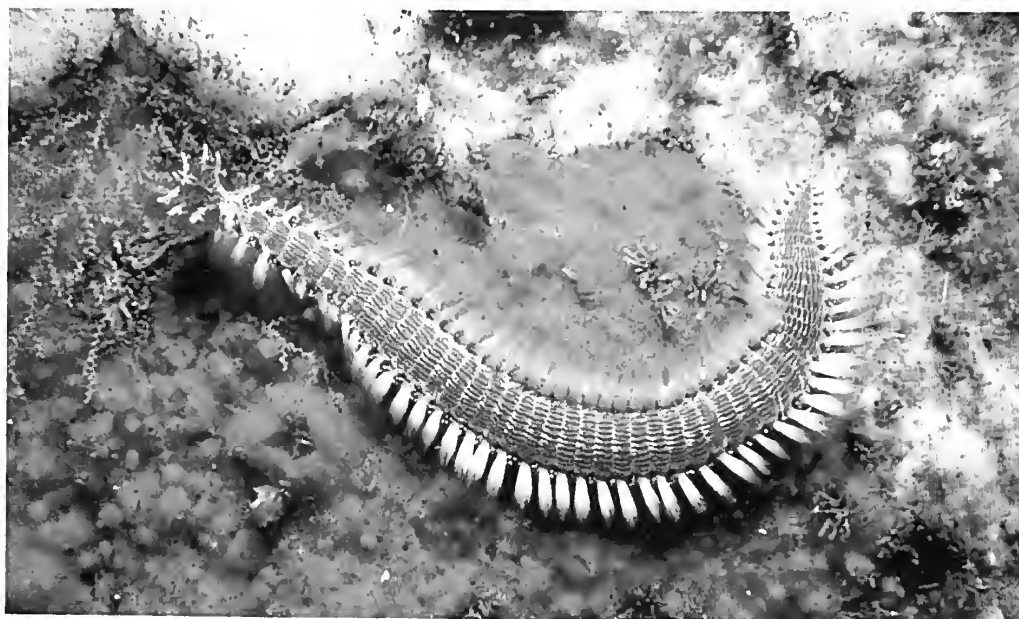


Fig. 5. *Pherecardia striata* found under a rock, Tulamben, Bali, Indonesia, showing the erect fan-shaped cartuncle on the head (left end). Photo Karen Gowlett-Holmes.

lacks a medial keel and is relatively wider than those of *Chloeia* and *Eurythoe*, but has several transverse folds (Fauchald 1977), which may serve to present a greater surface area for nuchal organ distribution.

Pherecardia striata (Kinberg)

The widespread tropical species *Pherecardia striata* (Fig. 5) is an active predator that will swallow pieces of fish and live prey such as small crabs, shelled gastropods, and other worms (Bailey-Brock 1987). On the Pacific coast of Panama, *Pherecardia striata* preys upon injured crown-of-thorns starfish (Glynn 1984). This carrion feeding ability is supported by the present observations of the species being caught by Hawaiian anglers on baited hooks (5 to 7 incidences over twenty years or longer). The worms are caught close to the rubble bottom, either from the shore or from small boats. Further, observations in aquaria show that this species can be hand fed (J.B.-B. pers. obs.). Worms will emerge from under a rock and come off the bottom and swim to the surface to take a piece of fish or meat held in a pair of forceps. In this instance the chemosensory structures detect the food before vision comes into play. The caruncle of *Pherecardia striata* is similar to that of *Chloeia* species (Kudcnov 1995). Like that in *Chloeia*, it also appears to be able to be held erect in worms foraging on the seabed (Fig. 5).

CONCLUSIONS

The examples above are indicative of true scavenging behaviour in which carrion is detected and located. Chemoreception appears to be the main way of detecting carrion in the Amphinomidae; this has been shown here for *Pherecardia striata* in aquaria and in the laboratory (Glynn 1984). The nuchal organs, ciliated structures behind the head, are likely to be the primary site for receiving chemical cues, although this has never demonstrated experimentally in any polychaete. In the Amphinomidae, the nuchal organs are arranged in bands around a large, often folded structure called the caruncle. All four genera dealt with here have well-developed caruncles and nuchal organs on the head just posterior to the eyes. In at least two genera (*Chloeia* and *Pherecardia*), the caruncles carrying the nuchal organs appear to be held erect in foraging, further evidence of their chemosensory role. The presence of well-developed nuchal organs and bait-taking abilities of these species suggests that amphinomids are among the best scavenging experts in the Polychaeta.

ACKNOWLEDGMENTS

We are grateful to Brian Paavo, University of Hawaii, for his observations on *E. complanata* and helpful

comments on a draft of the manuscript. We thank the polychaete research community for their generosity in responding to an email request for information on bait-taking worms. Karen Gowllett-Holmes, Kathy Atkinson, David George and Tim Berra kindly allowed us to use their excellent photographs.

REFERENCES

- Bailey-Brock, J.H. 1987. Chapter 2. Annelida. In: Devaney, D.M. and Eldredge, L.G. (eds) *Reef and Shore Fauna of Hawaii*. Pp. 213-454. Bishop Museum Special Publication 64 (2 and 3). Bishop Museum Press: Honolulu, Hawaii.
- Britton, J. C. and Morton, B. 1994. Marine carrion and scavengers. *Oceanography and Marine Biology: an Annual Review* 32: 369-434.
- Eisig, H. 1887. Monographie der Capitelliden des Golfes von Neapel und der angrenzenden meeres-abschnitte nebst untersuehungen zur vergleichenden anatomic und physiologie. *Fauna und Flora des Golfes von Neapel und der angrenzenden meeres-abschnitte herausgegeben von der Zoologischen Station zu Neapel* 16: 1-906.
- Fauchald, K. 1977. The polychaete worms. Definitions and keys to the orders, families and genera. *Natural History Museum of Los Angeles County, Science Series* 28: 1-188.
- Fauchald, K. and Jumars, P.A. 1979. The diet of worms: a study of polychaete feeding guilds. *Annual Review of Oceanography and Marine Biology* 17: 193-284.
- Fauvel, P. 1923. Polyhètes errantes. *Faune de France* 5: 1-488.
- Glynn, P.W. 1984. An amphinomid worm predator of the crown-of-thorns sea star and general predation of asteroids in eastern and western Pacific coral reefs. *Bulletin of Marine Science* 35: 54-71.
- Information Leaflet No. 17. 'Fire' Worms. Museums & Art Gallery of the Northern Territory.
- Kudcnov, J.D. 1995. Family Amphinomidae Lamarek, 1818. In: Blake, J.A., Hilbig, B. and Seott, P.H. (eds) *Taxonomic Atlas of the benthic fauna of the Santa Maria Basin and Western Santa Barbara Channel. Volume 5. The Annelida. Part 2. Polychaeta: Phyllodoidea (Syllidae and scale-bearing families), Amphinomida, and Eunicida*. Pp. 207-216. Santa Barbara Museum of Natural History: Santa Barbara, California.
- Marsden, J.R. 1963. The digestive tract of *Hemnodice carunculata* (Pallas). Polychaeta: Amphinomidae. *Canadian Journal of Zoology* 41: 165-184.
- Parenzan, P. 1980. Un reperto interessante nel mare di porto cesareo. *Thalassia Salentina* 10: 135-137.
- Paxton, H. 1979. Taxonomy and aspects of the life history of Australian beachworms (Polychaeta: Onuphidae). *Australian Journal of Marine and Freshwater Research* 30: 265-294.
- Pettibone, M.H. 1989. Revision of the aphroditoid polychaetes of the family Acoetidae Kinberg (=Polyodontidae Augener) and reestablishment of Acoetes Audouin and Milne-Edwards, 1832, and Euaechme Ehlers, 1887. *Smithsonian Contributions to Zoology* 464: 1-138.
- Saint-Loup, R. 1889. Sur le *Polyodontes maxillosus*. *Comptes rendus Hebdomadaires des Séances de l'Académie des Sciences* 109: 412-414.

Accepted 16 October 2001

A new genus and species of Syllidae (Annelida: Polychaeta) commensal with octocorals

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ABSTRACT

A survey of cnidarian material from Darwin Harbour, northern Australia, in the collection of the Museum and Art Gallery of the Northern Territory, yielded two species of commensal syllid polychaetes: *Haplosyllis* cf. *bisetosa* Hartmann-Schröder, 1960, an alcyonacean commensal previously known only from the Red Sea, plus a new species (and genus) of Syllinae, *Alcyonosyllis phili*. The new genus is characterised by having simple hooked chaetae with a subdistal boss and unarticulated dorsal cirri which are arranged in an alternating pattern of large, dorsally displaced cirri and smaller, lateral ones. *Haplosyllis xeniaeicola* Hartmann-Schröder, 1993, which is also a commensal of alcyonaceans, is transferred to this new genus. *Alcyonosyllis phili* was found on nephtheid soft corals and gorgonians from the northwestern, northern and eastern coasts of Australia; it also occurs in southern New Guinea. Observations on the number of hosts harbouring *A. phili* and *Haplosyllis* cf. *bisetosa* and the number of worms per host are also provided.

KEYWORDS: Syllidae, Polychaeta, octocoral, alcyonacean, taxonomy, symbiotic, commensal, new genus, new species.

INTRODUCTION

The Syllidae (Polychaeta: Nereidoidea) is a large family with about 70 genera and over 600 species worldwide (Kudenov and Harris 1995); the Australian fauna comprises at least 32 genera and over 77 species (Glasby 2000). Compared to other polychaete groups, Syllidae are relatively commonly associated with other marine invertebrates, either as commensals on the surface of the host or as parasitic endobionts. Over 20 species belong to the former category (Martin and Britayev 1998), including five species of *Haplosyllis*, which are commensal on soft corals.

The discovery of a large, vividly coloured syllid associated with a nephtheid soft coral (Alcyonacea) from Darwin Harbour, Northern Territory, led to a survey of similar alcyonaceans (and other cnidarians) in the collections of the Museum and Art Gallery of the Northern Territory. The syllid resembled some species of *Haplosyllis* in having simple chaetae exclusively, but differed in other important features such as the form and arrangement of the dorsal cirri. It is described here as a new genus and species, *Alcyonosyllis phili* n. gen. n. sp. The survey of alcyonacean material revealed a second, much smaller species of syllid which closely

resembled *Haplosyllis bisetosa* Hartmann-Schröder, 1960. Because the type material of *H. bisetosa* is in poor condition (CJG, pers. obs.), we were unable to provide here an unequivocal identification; these specimens will be described in a subsequent paper.

The syllids (and other commensal polychaetes) were removed from the alcyonacean hosts and registered separately from the hosts. The number of worms per host was estimated based on total number of commensals and hosts per sample, because of the possibility of cross-transfer of worms between hosts after the sample was collected. Typically there were 1-6 host alcyonaceans per sample. Observations and drawings were made with a Wild M8 dissecting microscope, and Leitz Laborlux compound microscope with drawing tube. Type material has been deposited at the Los Angeles County Museum of Natural History, Los Angeles, formerly Allan Hancock Foundation (LACM-AHF), Natural History Museum, London (BMNH), Museo Nacional de Ciencias Naturales de Madrid (MNCN) and the Museum and Art Gallery of the Northern Territory, Darwin (NTM). All other material is housed in the NTM. Material for comparative purposes was borrowed from the Forschungsinstitut und Naturmuseum Senckenburg, Frankfurt (SMF).

SYSTEMATICS

Family Syllidae Grube, 1850
 Subfamily Syllinae Grube, 1850
Alcyonosyllis n. gen.

Diagnosis. Syllinae with long body and large number of chaetigers. Prostomium with 2 pairs of eyes, 3 antennae; palps free to base. Nuchal organs are an inconspicuous ciliated ridge between prostomium and tentacular segment. Two pairs of tentacular cirri. Antennae, tentacular cirri and dorsal cirri unarticulated. Alternating dorsal cirri of two types: longer and thicker cirri held erect and curling over dorsum, slightly displaced dorsally compared to shorter ones; shorter and thinner cirri laterally directed. Ventral cirri present, extending to level of parapodial lobes. Parapodia uniramous, bearing subacicular unarticulated hooked chaetae with subdistal boss. Pygidium carrying pair of large unarticulated cirri. Pharynx with single anterior mid-dorsal tooth; rim smooth; 10 terminal papillae.

Type species. *Alcyonosyllis phili* n. sp. by original designation.

Included species. *Alcyonosyllis phili* n. sp.; *Alcyonosyllis xeniaeicola* (Hartmann-Schröder, 1993) new combination.

Remarks. The new genus belongs to the subfamily Syllinae as currently circumscribed (Garwood 1991; Kudenov and Harris 1995) as it has palps that are free basally, small and inconspicuous nuchal organs, two

pairs of tentacular cirri, ventral cirri present, and it reproduces by schizogamy (budding off of sexual individuals, or stolons, from the adult, or stock). The new genus differs most strikingly from most syllines in having unarticulated tentacular and dorsal cirri. A comparison of major features of this new genus with those of other syllids having exclusively simple chaetae is given in Table 1.

Based on the above generic definition *Haplosyllis xeniaeicola* Hartmann-Schröder, 1993 should be transferred to *Alcyonosyllis* (see Remarks under species description). Possibly other species currently allocated to *Haplosyllis* could also belong to *Alcyonosyllis*, but this is best assessed during a revision of the genus. *Haplosyllis* currently comprises species with articulated or unarticulated dorsal cirri and very different types of simple chaetae — tomahawk-shaped ones (*sensu* Licher 1999) and those with a subdistal boss (Hartmann-Schröder 1978: table 1). The most widely reported species in the genus, the sponge commensal *Haplosyllis spongicola*, is currently being revised (D. Martin pers. comm.).

Alcyonosyllis differs from *Trypanosyllis* (*Trypanobia*) in having a subcylindrical rather than a flattened body; it differs from *Bollandia* in having three antennae; it differs from *Bollandia*, *Haplosyllides* and *Trypanosyllis* (*Trypanobia*) in having large, basally-free palps; it differs from *Geminosyllis*, *Haplosyllis*, *Parahaplosyllis* and *Trypanosyllis* (*Trypanobia*) in having unarticulated

Table 1. Comparison of features of *Alcyonosyllis* with other syllid taxa characterised by the exclusive presence of simple chaetae. Characterisation of each genus based on type species. Additional data for *Haplosyllides* from San Martin *et al.* (1997). ¹Originally this genus was interpreted as lacking antennae and having three pairs of tentacular cirri (Glasby 1994); however an equally likely possibility is the presence of one pair of antennae and two pairs of tentacular cirri. ²Tomahawk type chaetae (*sensu* Licher 1999) have a large laterally-projecting subdistal tooth and a smaller distal tooth (which may be bifid).

	Body shape	Antennae (number)	Palps	Tentacular cirri	Pharynx (armature)
<i>Alcyonosyllis</i> n. gen., n. sp.	Subcylindrical	3	Large, free basally	2 pairs, unarticulated	Subdistal dorsal tooth
<i>Bollandia</i> Glasby	Subcylindrical	0 or 2 ¹	Absent	2 or 3 pairs ¹ , unarticulated	Unarmed
<i>Geminosyllis</i> Imajima	Subcylindrical	3	Large, free basally	2 pairs, articulated	Subdistal dorsal tooth and trepan
<i>Haplosyllis</i> Langerhans	Subcylindrical	3	Large, free basally	2 pairs, articulated	Subdistal dorsal tooth
<i>Haplosyllides</i> Augener	Subcylindrical	3	Fused forming a single bilobed structure	2 pairs, unarticulated	Subdistal tooth (absent in large worms)
<i>Parahaplosyllis</i> Hartmann- Schröder	Unknown	3	Small, oval-shaped; free to base	2 pairs, articulated	? Subdistal tooth
<i>Trypanosyllis</i> (<i>Trypanobia</i>) Imajima and Hartman	Flattened	3	Very reduced (not visible dorsally)	?2 pairs, articulated	Trepan only

dorsal and tentacular cirri. It is distinguished from all sylline genera except *Haplosyllis* and *Haplosyllides* in having a subdistal dorsal tooth as the only form of pharyngeal armature. It is unique among the syllines with simple chaetae in the form and alternation pattern of the dorsal cirri and type of chaetae (Table 1).

The new genus is superficially similar to *Parasphaerosyllis* Monro in having alternating large and small dorsal cirri. However, the smaller dorsal cirri of *Parasphaerosyllis* are articulated, the larger cirri have a distinct terminal palpode, and both appear to arise at the same level laterally. Moreover, *Parasphaerosyllis* has both compound bifid chaetae and simple slender bifid chaetae, which are typical of many Syllidae.

Etymology. The compound name of the new genus is formed from the scientific name for soft corals (Alcyonacea) and *Syllis*, the type genus of the polychaete family (and a Latin word for worm), indicating the close ecological association between the worm and certain types of soft coral. The gender is feminine.

Alcyonosyllis phili n. sp.

(Figs 1-5)

Material examined. HOLOTYPE - East Arm Port, Darwin Harbour (12°29.4' S 130°53.9' E), intertidal reef flat, coll. P. Alderslade, 14 November 2000, NTM W17206. PARATYPES - same collection details as for holotype, 3(NTM W17208), 1(NTM W17209). East Arm

Port, Darwin Harbour, intertidal reef flat, coll. C. Glasby, 11 January 2001, 1(NTM W17207), 2(LACM-AHF Poly2075), 3(BMNH ZB2001.6910-6912), 3(MNCN 16.01/8712). NON-TYPE MATERIAL - Northern Territory, Darwin Harbour, Stevens Rock, 5(NTM W17242), Angler Reef, Lee Point, 2(NTM W17213), 2(NTM W17214); off Dudley Point, 1(NTM W17215), 2(NTM W17216), 4(NTM W17217), 1(NTM W17218), Channel Rock, 2(NTM W17219). Western Australia, Condillae Island, Institute Group, 14°06.0' S 125°33' E, 1(NTM W6801), 1(NTM W6802), Albert Reef, 15 38.0' S 123°21.0' E 1(NTM W6807). New South Wales, Lord Howe Island, Ned's Beach (31°35.0' S 159°06.0' E), 1 m, (NTM W5015). Localities are given in the Appendix.

Other material examined. *Alcyonosyllis phili* Bootless Bay, Port Moresby, Papua New Guinea, 30.11.1996, photographic record, Neville Coleman. *Haplosyllis xeniaecola* holotype (SMF 4433/1).

Description. Holotype complete, with about 150 chaetigers, 28 mm long, maximum width (excluding parapodia) 1.2 mm. Paratype material ranges from 75 chaetigers, 13 mm long, 0.7 mm wide to 173 chaetigers, 56 mm long and 1.6 mm wide. Measurements and counts include posteriorly attached stolon when present (on holotype and most paratypes).

Description of holotype except where indicated. Body long, robust, similar in width throughout, except for slight tapering at head and tail ends, and slight

Table 1 (cont.). Comparison of features of *Alcyonosyllis* with other syllid taxa characterised by the exclusive presence of simple chaetae. Characterisation of each genus based on type species. Additional data for *Haplosyllides* from San Martin *et al.* (1997). 'Originally this genus was interpreted as lacking antennae and having three pairs of tentacular cirri (Glasby 1994); however an equally likely possibility is the presence of one pair of antennae and two pairs of tentacular cirri. ²Tomahawk type chaetae (*sensu* Licher 1999) have a large laterally-projecting subdistal tooth and a smaller distal tooth (which may be bifid).

	Dorsal cirri	Chaetae	Aciculae (number)
<i>Alcyonosyllis</i> n. gen., n. sp.	Alternating thick and slender types; unarticulated	2 types (distally recurved, no teeth; and distally recurved, minute subdistal tooth)	Include blunt tipped and tapered types (3-5)
<i>Bollandia</i> Glasby	All slender tapered, irregularly wrinkled	2 types (large, distally recurved, no teeth; and flail-tipped)	Tapered (1)
<i>Geminosyllis</i> Imajima	All slender, articulated	2 types (tomahawk ² and slender bifid types)	Blunt tipped (1-4)
<i>Haplosyllis</i> Langerhans	All slender, articulated (though variable in length)	1 type (tomahawk ² type)	Tapered anteriorly (2-3); posteriorly hooked (1-2)
<i>Haplosyllides</i> Augener	All slender, unarticulated	2 different sizes (both tridentate)	Straight, blunt tipped (1)
<i>Parahaplosyllis</i> Hartmann-Schröder	Short, indistinct articulations	3 types (tomahawk ² , bidentate, and slender spines)	Distally knobbed
<i>Trypanosyllis</i> (<i>Trypaubolia</i>) Imajima and Hartman	All slender, articulated	* 1-3 types (including furcate, falcate types with or without subdistal spur)	Distally bent or blunt-tipped (4)

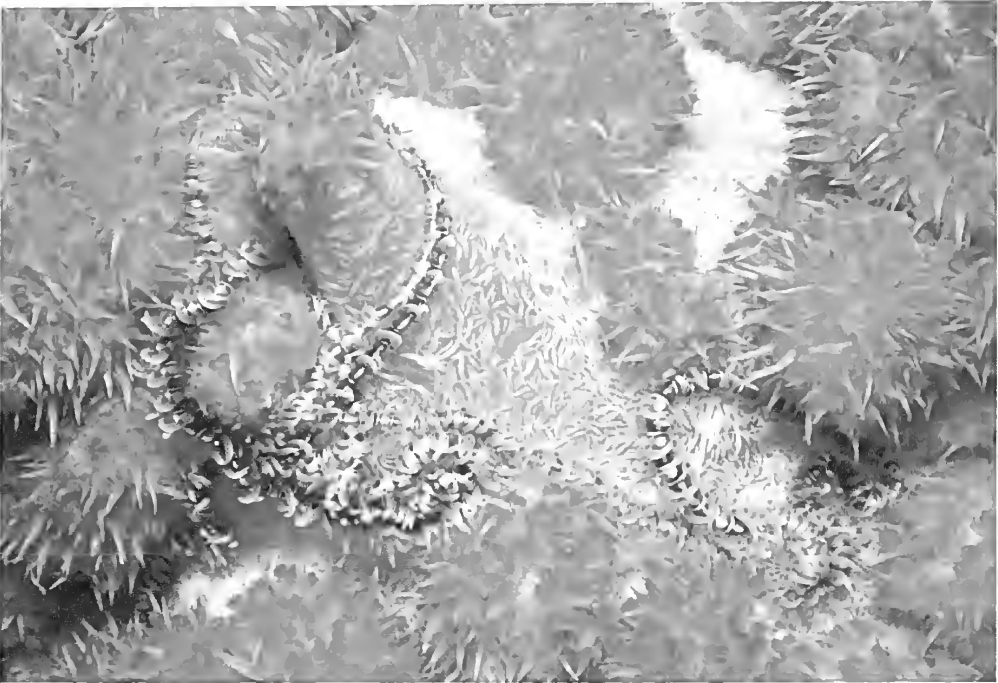


Fig. 1. *Alcyonosyllis phili* n. gen., n. sp. *in situ* on a species of *Dendronephthya*, Bootless Bay, Port Moresby, New Guinea. Photo by Neville Coleman.



Fig. 2. *Alcyonosyllis phili* n. gen., n. sp. *in vitro* on a nephtheid host from Darwin Harbour (NTM W17242). The recently fixed specimen differs from the live appearance in having less pigment intensity and in the large dorsal cirri which are held erect rather than arching over the dorsum. Photo by Neville Coleman.

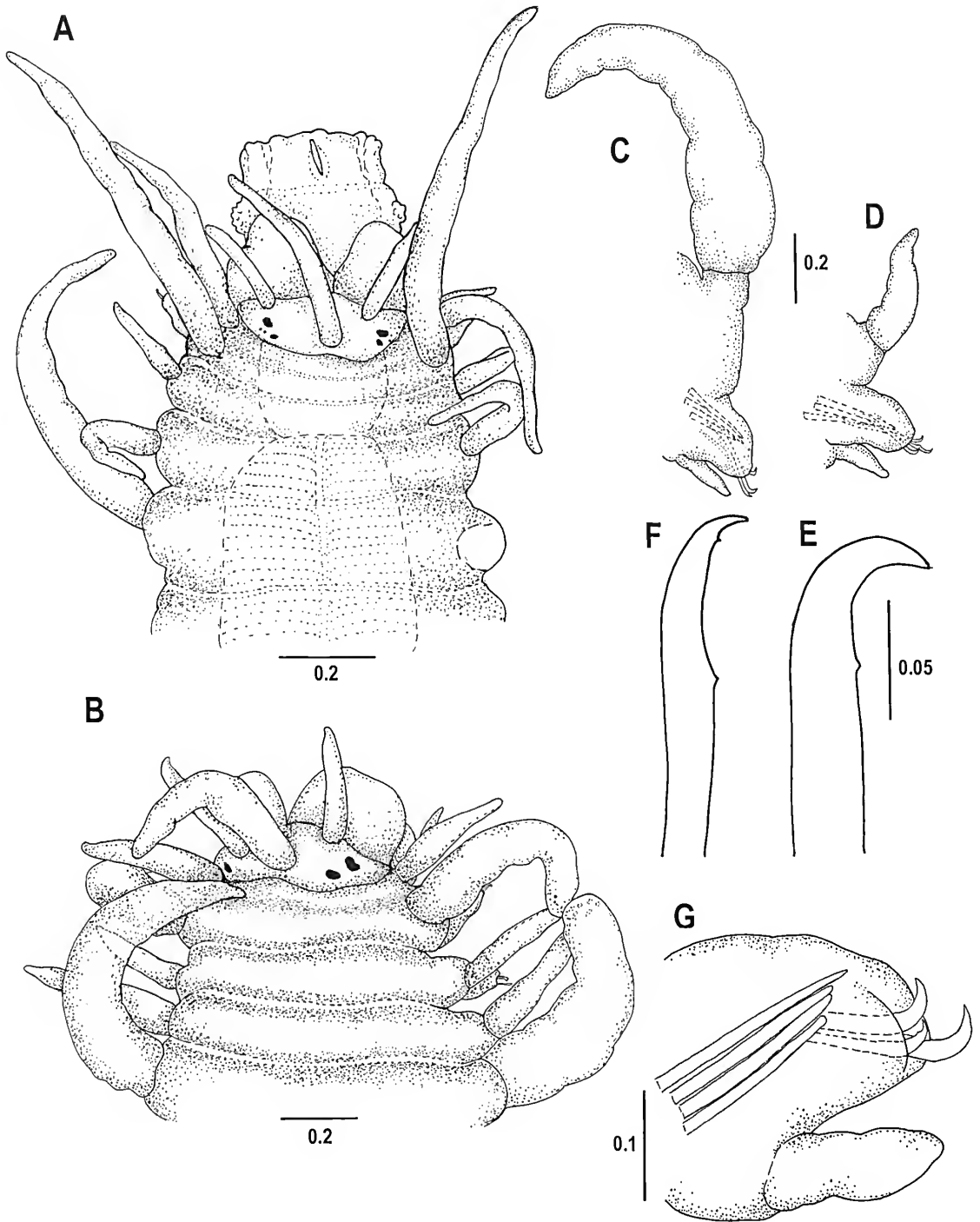


Fig. 3. *Alcyonosyllis phili* n. gen, n. sp. **A**, paratype (NTM W17209), head end, dorsal view with everted pharynx showing mid-dorsal pharyngeal tooth; **B**, paratype (NTM W17208), head end, dorsal view with retracted pharynx; **C**, holotype (NTM W17206), parapodium of chaetiger 25, showing larger-type dorsal cirri; **D-F**, holotype (NTM W17206); **D**, parapodium of chaetiger 12, showing smaller-type dorsal cirri; **E**, thicker simple chaeta of mid-body; **F**, slender simple chaeta of same mid-body chaetiger; **G**, non-type (NTM W5015), parapodium of anterior chaetiger, showing arrangement of aciculae (dorsal cirrus not shown). Scale bars are in mm.

constriction at about chaetiger 105 corresponding to junction between stock and stolon. Cream coloured with transverse brown pigment bands (flanked on either side by thin white stripe) on dorsum of peristomium and chaetigers 2,3,5,7,8,10 and thereafter on all even chaetigers (Figs 1,2). Venter more-or-less uniformly light brown. Pigment pattern generally faded in preserved specimens.

Prostomium sub-quadrangular, about twice as wide as long (Fig. 3A, B). Two pairs dark laterally-positioned eyes, similar in size. Median antenna situated on mid-posterior prostomium, about twice length and thickness of lateral antennae. Palps large, slightly longer than length of prostomium, free to base. Antennae more-or-less smooth. Tentacular segment projecting slightly mid-anteriorly to cover nuchal organs, carries two pairs of cirri; dorsal pair slightly thicker and twice length of ventral pair (dorsal pair slightly smaller than median antenna, ventral pair slightly smaller than lateral antennae).

First and subsequent chaetigers bearing dorsal and ventral cirri and sub-conical parapodial lobe; pre-chaetal lip slightly more prominent than post-chaetal lip in anterior body. Dorsal cirri of two distinct forms: dorsally-displaced larger cirri with distinct cirrophore on chaetigers 1,4,6,9,11 and thereafter on odd chaetigers (Fig. 3C); unarticulated, inflated, tapering to a point; held erect and curved over dorsum (Figs 3A-C). Smaller, laterally-directed dorsal cirri arise closer to parapodial lobes than larger cirri on chaetigers 2,3,5,7,8,10 and thereafter on even chaetigers, i.e., same chaetigers having brown bands; $1/3 - 1/4$ length of larger ones (Fig. 3D). Dorsal cirri on chaetiger 2 slightly shorter than subsequent smaller cirri. Ventral cirri smooth, approx-

imately equal in length to parapodial lobe (Fig. 3C,D). Each parapodium typically bearing 2 or 3 unarticulated hooked chaetae (rarely 1) ventral to aciculae (Fig. 3C-D,G); thicker chaeta more hooked and with very slight subdistal boss (Fig. 3E); thinner chaeta with more prominent V-shaped subdistal boss and often with minute tooth immediately below hook (Fig. 3F). Aciculae consist of 3-5 straight, blunt-tipped types per parapodium, and 1 or 2 more slender types with attenuated tip, which extend slightly beyond others (Fig. 3G).

Pygidium small, inflated slightly, carrying pair of large unarticulated cirri, similar to enlarged dorsal cirri.

Gut not visible through body wall in living or preserved (unmounted) material. Pharynx retracted in holotype. Retracted pharynx occupying first 4-5 chaetigers; slightly curved hyaline tooth on dorsal surface distally (Fig. 3A); anterior rim chitinated with smooth border. Ten low pharyngeal papillae visible on specimens with fully everted pharynges. Proventricle occupying chaetigers 4-5 to chaetigers 9-10 with about 40 muscle cell rows (Fig. 3A).

Single male or female stolons ranging in size from 37-65 chaetigers occur on most type specimens; they lack head appendages and epitokal chaetae and are not fully mature. Specimens with large stolons have cleft ventral protuberance at point of attachment of stolon representing new tail end.

Variation. A few non-type specimens (e.g. NTM W17217) with fully mature stolons attached to stock. Stolons with 2 pairs of anterolateral eyes and 2 pairs of lateral antennae (Fig. 4); body generally enlarged relative to that of stock, hook chaetae are withdrawn within parapodia, and emergent capillary epitokal



Fig. 4. *Alcyonosyllis philii* n.gen, n. sp. Non-type specimen (NTM W17217), dorsal view, with fully mature stolon attached to stock showing 2 pairs of anterolateral eyes and 2 pairs of lateral antennae.



Fig. 5. *Alcyonosyllis philii* n.gen, n. sp. Non-type specimen (NTM W17217), lateral view, with regenerating tail end on venter at junction of stock and stolon comprising about 20 short segments and small pygidium bearing a pair of anal cirri.

chaetae appear between parapodial lobe and dorsal cirrus. Epitokal chaetae absent on body of stock. Specimen NTM W17217 with regenerating tail end on venter at junction of stock and stolon comprising about 20 short segments, each with aciculae but no external chaetae and small pygidium bearing pair anal cirri (Fig. 5).

Live specimens usually vividly coloured with brown bands and blue to purple pigment spot at base of antennae, dorsal and tentacular cirri and dark tips; pigment pattern fades rapidly after fixation (Figs 1,2). Intensity of pigmentation variable in living material, occasionally almost completely absent (e.g. NTM W17209).

Distribution and habitat. *Alcyonosyllis philii* n. gen. n. sp. occurs on the northwestern, northern and eastern coasts of Australia, and southern Papua New Guinea. The Darwin material was found on an undescribed genus and species of Nephtheidae; and the Papua New Guinea specimen was photographed on a species of *Dendronephthya* (Nephtheidae). Western Australian material occurred on both nephtheids and a gorgonian (*Melithaea* sp.) and the New South Wales material occurred on a different species of *Melithaea*.

Remarks. Five species of *Haplosyllis* have been reported in the literature as having cnidarian hosts: *H. anthogorgicola* Utinomi on the gorgonian *Anthogorgia bocki* (Utinomi 1956; Imajima and Hartman 1964); *H. bisetosa* Hartmann-Schröder on an unidentified alcyonacean (Hartmann-Schröder 1960); *H. chamaelon* Laubier on the gorgonian *Paramuricea clavata* (Laubier 1960; López *et al.* 1996); *H. xeniaecola* Hartmann-Schröder on the alcyonacean *Xenia viridis* (Hartmann-Schröder 1993); and a new species on the gorgonian *Villogorgia bebbrycoides* currently being described by Martin *et al.* (D. Martin, pers. comm.). *Haplosyllis anthogorgicola*, *H. chamaelon* and the new species of Martin *et al.* differ from the new taxon in the form of the simple chaetae: *H. chamaelon* and the new species of Martin *et al.* have a supra-distal secondary tooth; *H. anthogorgicola* has typical *Haplosyllis*-type tomahawk chaetae. All five species, except *H. xeniaecola*, differ from the new taxon in having dorsal cirri that are articulated and of similar thickness throughout.

Based on a comparison of type material, the new taxon resembles most closely *Haplosyllis xeniaecola* from Ternate, Maluku, Indonesia. Indeed, the similarities are such that we consider *H. xeniaecola* should be classified together with *A. philii*, under *Alcyonosyllis*. Both species have dorsal cirri that are unarticulated, with the larger cirri being slightly displaced dorsally. The two species differ in the detail of the dorsal cirri arrangement pattern and in the form of the chaetae: the dorsal cirri of *H. xeniaecola* from the midbody onward

have a weak length-alternation pattern (all cirri being more-or-less long, greater than the body width). Further, in *H. xeniaecola* the simple chaetae within a parapodium are of similar thickness (not subequal as in *A. philii*), they do not have a definite subdistal tooth (the smaller chaeta has a subdistal tooth in *A. philii*), and the angle of the recurved tip is shallower in *H. xeniaecola* (see Hartmann-Schröder 1993: figs 2-5). Further, *H. xeniaecola* has a peculiar pigmented (sclerotised?) pharynx, visible through the body wall, which is absent in the new species.

This new species is schizogamous. All specimens, except the smallest, have a single reproductive stolon attached posteriorly to the adult stock. Segments are added to the stolon from the prepygidial proliferative zone of the stock, a process known as scissiparity and common in many syllines (Garwood 1991). While the stolon is still developing, a new tail end and pygidium forms on the ventral surface at the junction between the stock and the stolon. Probably after release of the stolon, the stock will regain its pre-reproductive form, and therefore survive to reproduce again. The initial stages of pygidium formation appears to be similar to that in *Haplosyllis chamaeleon* Laubier, 1960 (D. Martin, pers. comm.), with both species having two small ventro-lateral protuberances between the stock and the stolon. However, in *H. chamaeleon* the two protuberances remain separated even after stolon release, whereas in *A. philii*, the two protuberances fuse at a very early stage to produce a single 20-chaetiger tail end before the stolon is released. Observations on the form and fate of the adult syllid after it releases its stolon are rare in the literature, but the differences exhibited by *A. philii* and *H. chamaeleon* indicate that it could be a useful character to distinguish species, and perhaps even genera.

Etymology. The species is named after our colleague and friend Philip Alderslade (Curator of Cnidarians, NTM) who collected the first specimens and helped with octocoral identification.

BIOLOGY OF THE COMMENSAL SYLLIDS

The occurrence of *Alcyonosyllis philii* on at least two different species of alcyonacean (an undescribed genus and *Dendronephthya*) and two different species of gorgonian is noteworthy. All other symbiotic species of *Haplosyllis* associated with cnidarians, including the *Haplosyllis* cf. *bisetosa*, are apparently monoxenous (restricted to a single host) (Martin and Britayev 1998), although data are few and most associations are poorly known. Both *A. philii* and *H. cf. bisetosa* appear not to harm the host or induce the formation of secondary shelter-like structures, which have been noted for other cnidarian symbiotic syllids (Glasby 1994; Martin and Britayev 1998). Therefore the relationship in both cases

appears to be commensal. Both *A. phili* and *H. cf. bisetosa* may be obligatory commensals because free-living forms are unknown.

About 70 preserved nephtheids from the Darwin region were examined for the presence of polychaete commensals. The most commonly occurring commensal was *Haplosyllis cf. bisetosa*, which occurred on most of the nephtheids examined. *Alcyonosyllis phili* occurred on about half of the nephtheid specimens examined, usually the larger ones (Table 2). Both syllid species commonly occur on the same host. This appears to be the first time that two commensal polychaetes from the same family have been reported from the same host species. The only other commensal species found in the survey (a polynoid) occurred in low numbers on two specimens (NTM C4901, NTM C11784).

The number of commensals per host varied from 0 to 28 in *Haplosyllis cf. bisetosa* and 0 to 3 in *Alcyonosyllis phili* (Table 2). These figures are not precise because the material examined was not collected

for the prime purpose of quantitatively estimating commensal numbers. The alcyonacean hosts were not always relaxed prior to fixation, and resulting muscle contraction and body wall distortion tended to obscure the smaller polychaete commensals.

The purpose of the vivid colour pattern of *A. phili* is perplexing. The striking banded pattern (Figs 1,2) would appear not well suited for camouflage particularly on a host whose colour ranges from light pink to crimson. Indeed, the worms could be easily seen on all hosts, despite their colour, during intertidal field collecting. However, the worms do appear to be able to alter the intensity of their colour pattern to more closely resemble that of the host. For example, one of the paratypes (NTM W17209), found on a light pink nephtheid, was almost devoid of pigment, with the banding pattern only just discernable. Further, a commensal species of ophiuroid and an isopod found on the same host as specimens of *A. phili* (NTM W17242) showed similar brown banding patterns. So it appears as though the

Table 2. Nephtheid material examined for the presence of syllid commensals showing numbers of specimens and NTM registration numbers at various localities in, and around, Darwin Harbour. Localities are given in the Appendix.

Nephthidae sp.		<i>Alcyonosyllis phili</i>			<i>Haplosyllis cf. bisetosa</i>		
specimen lot	no.	specimen lot	no.	rate of occurrence	specimen lot	no.	rate of occurrence
C3474	2		0	0	W17221	10	5.0
C3779	2		0	0	W17222	1	0.5
C3781	1	W17213	2	2.0	W17223	7	7.0
C3811	2		0	0	W17224	15	7.5
C3812	6	W17214	2	0.33	W17225	5	0.83
C3783	5		0	0	W17226	3	0.60
C4613	1		0	0		0	0
C4888	3	W17215	1	0.33		0	0
C4889	4		0	0	W17227	1	0.25
C4891	3	W17216	2	0.66	W17228	2	0.66
C4900	3	W17217	4	1.33		0	0
C4901	2	W17218	1	0.50		0	0
C5710	>5		0	0		0	0
C11108	3	W17219	2	0.66	W17229	6	2.0
C11711	1		0	0	W17230	28	28.0
C11712	4		0	0	W17231	14	3.5
C11784	1		0	0	W17232	15	15.0
C13076	1		0	0	W17233	6	6.0
C13141	1	W17210	1	1		0	0
C13140	1	W17208	3	3		0	0
C13137	1		0	0	W17234	5	5.0
C13138	1	W17211	1	1		0	0
C13144	3		1	0.33	W17235	2	0.66
C13143	1	W17212	1	1		0	0
C13139	1		0	0	W17236	1	1.0
C13142	1	W17206	2	2	W17237	1	1.0
		W17207					
C13145	2		0	0	W17238	5	2.5
C13146	3		0	0	W17239	2	0.66

colouration of *A. phili* may well have a camouflage function, but clearly this is an area that needs further investigation.

ACKNOWLEDGMENTS

We thank Phil Alderslade for bringing the presence of the syllid polychaete on soft corals to the senior authors' attention and for assistance identifying the cnidarians; Daniel Martin and Guillermo San Martin for stimulating discussions on commensal syllids, and the former for access to unpublished research; Neville Coleman for permission to use his colour slide; Belinda Alvarez de Glasby for scanning and editing the illustrations; and Pat Hutchings and Daniel Martin for helpful reviews.

REFERENCES

- Garwood, P.R. 1991. Reproduction and the classification of the family Syllidae (Polychaeta). In: Petersen, M.E. and Kirkegaard, J.B. (eds) *Systematics, biology and morphology of world Polychaeta. Proceedings of the 2nd International Polychaete Conference, Copenhagen, 1986*. Pp. 81-87. *Ophelia* Supplement 5. *Ophelia* Publications: Helsingør.
- Glasby, C.J. 1994. A new genus and species of polychaete, *Bollandia antipathicola* (Nereidoidea: Syllidae), from black coral. *Proceedings of the Biological Society of Washington* **107**: 615-621.
- Glasby, C.J. 2000. Family Syllidae. In: Beesley, P.L., Ross, G.J.B. and Glasby, C.J. (eds) *Polychaetes & Allies: The southern synthesis. Fauna of Australia, Vol. 4A Polychaeta, Myzostomida, Pogonophora, Echinura, Sipuncula*. Pp 161-167. CSIRO Publishing: Melbourne.
- Grube, A.E. 1850. Die familien der Anneliden. *Archiv für Naturgeschichte, Berlin* **16**: 249-364.
- Hartmann-Schröder, G. 1960. Polychaeten aus dem Roten Meer. *Kieler Meeresforschungen* **16**: 69-125.
- Hartmann-Schröder, G. 1978. Einige Sylliden-Arten (Polychaeta) von Hawaii und aus dem Karibischen Meer. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* **75**: 49-61.
- Hartmann-Schröder, G. 1993. *Haplosyllis xeniaeicola*, ein neuer polychaet (Syllidae) von den Molukken (Indonesien). *Helgoländer Meeresuntersuchungen* **47**: 305-310.
- Imajima, M. and Hartman, O. 1964. The polychaetous annelids of Japan. *Occasional Papers of the Allan Hancock Foundation* **26**: 1-452.
- Kudenov, J.D. and Harris, L.H. 1995. Family Syllidae Grube, 1850. In: Blake, J.A., Hilbig, B. and Scott, P.H. (eds) *Taxonomic atlas of the benthic fauna of the Santa Maria Basin and western Santa Barbara Channel. Volume 5. The Annelida. Part 2. Polychaeta: Phyllodoidea (Syllidae and scale-bearing families), Amphinomida, and Eunicida*. Pp. 1-97. Santa Barbara Museum of Natural History: Santa Barbara, California.
- Laubier, L. 1960. Une nouvelle sous-espèce de syllidien: *Haplosyllis depressa* Augener ssp. nov. *chamaeleon*, ectoparasite sur l'octocorallaire *Muricea chamaeleon* Von Koch. *Vie et Milieu* **11**: 75-87.
- Licher, F. 1999. Revision der gattung *Typosyllis* Langerhans, 1879 (Polychaeta: Syllidae). Morphologie, Taxonomie und Phylogenie. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* **551**: 1-336.
- Lopez, E., San Martin, G. and Jimenez, M. 1996. Syllinae (Syllidae, Annelida, Polychaeta) from Chafarinas Islands (Alborán Sea, W Mediterranean). *Miscellanea Zoologica* **19**: 105-118.
- Martin, D. and Britayev, T.A. 1998. Symbiotic polychaetes: review of known species. *Oceanography and Marine Biology: an Annual Review* **36**: 217-340.
- San Martín, G., D., Ibarzábal, M., Jiménez, M. and López, E. 1997. Redescription of *Haplosyllides floridana* Augener, 1924 (Polychaeta: Syllidae: Syllinae), with notes on morphological variability and comments on the generic status. *Bulletin of Marine Science* **60**: 364-370.
- Utinomi, H. 1956. On the so-called "Umi-Utiwa", a peculiar flabellate gorgonacean, with notes on a syllidean polychaete commensal. *Publications of the Seto Marine Biological Laboratory* **5**: 243-250.

Accepted 29 October 2001

Appendix. Localities for host and commensal worms listed in Table 2.

Specimen lot	Locality
C3779, C3781, C3811, C3812, C3783, W17213-4, W17221-6	Angler Reef, Lee Point, Darwin Harbour
C4888, C4889, C4891, C4900-1, W17215-17218, W17227-8	Off Dudley Point, Darwin Harbour
C11108, W17219, W17229	Channel Rock, Darwin Harbour
C11711, W17230	Pump House, Darwin Wharf, Darwin Harbour
C11712, W17231	Stokes Hill Wharf, Darwin Harbour
C13076, W17233	Channel Island, Darwin Harbour
C13137-13146, W17206- 17208, W17210-17212, W17234-17240	East Arm Port, Darwin Harbour
C3474, W17221	Sandy Is No. 2, Cobourg Peninsula
C4613	New Year Island, off Cobourg Peninsula
C11784, W17232	Palm Bay, Croker Island, off Cobourg Peninsula
C5710	Orontes Reef, Port Essington

A new species of *Pentapodus* (Teleostei: Nemipteridae) from the western Pacific

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ABSTRACT

Pentapodus aureofasciatus is described as a new species of whiptail bream (family Nemipteridae) based on specimens collected from the Ryukyu Is, Taiwan, Indonesia, Papua New Guinea, north-eastern Australia, New Caledonia, Fiji, Tonga and Samoa. The species is similar to other congeners in general appearance, but is characterised by having scales on top of the head not reaching forward to a line between the posterior nostrils; lower limb of preopercle with 2 or 3 scale rows; lateral-line scales 42 to 48 (usually 46 or 47); caudal fin forked, lobes more or less equal in length, and lacking filamentous extensions; and by having a distinctive broad pale yellow band along the body from behind eye to caudal peduncle. A key to the species of *Pentapodus* is provided.

KEYWORDS: Nemipteridae, *Pentapodus*, whiptail bream, new species, tropical western Pacific.

INTRODUCTION

The whiptail breams of the genus *Pentapodus* (family Nemipteridae) are a small group of fishes found only in the tropical western Pacific. They are mostly medium-sized (to about 20 cm total length), coral reef species, although some range over soft substrata, usually associated with sponge beds or other benthic communities in depths less than 100 m.

The genus has been reviewed by Fowler (1933), Weber and de Beaufort (1936), and more recently by Russell (1990), who recognised nine species: *Pentapodus bifasciatus* (Bleeker), *P. caninus* (Cuvier), *P. emeryii* (Richardson), *P. nagasakiensis* (Tanaka), *P. paradisens* (Günther), *P. porosus* (Valenciennes), *P. setosus* (Valenciennes), *P. trivittatus* (Bloch), *P. vitta* Quoy and Gaimard, and an undescribed species.

The species of *Pentapodus* previously recognised by Russell (1990) as undescribed, is described herein as new. A key to the species of *Pentapodus* is provided.

METHODS AND MATERIALS

Methods of counting and measuring specimens follow Russell (1986). Counts and measurements are based on a wide range of material. In the new species description, measurements and counts for the holotype are given first. Those for the paratypes, where different from the holotype, are enclosed in parentheses. Specimens examined are in the following institutions: Australian Museum, Sydney (AMS); Institute of

Zoology, Academia Sinica, Taiwan (ASIZP); Museum of Natural History, London (BMNH); Bernice P. Bishop Museum, Honolulu (BPBM); Queensland Museum, Brisbane (QM); Museum and Art Gallery of the Northern Territory, Darwin (NTM); University of Ryukyus, Okinawa (URM); Western Australian Museum, Perth (WAM).

SYSTEMATICS

Family Nemipteridae

Pentapodus aureofasciatus n. sp.

Figs 1, 2

Pentapodus nagasakiensis (non Tanaka). - Fourmanoir and Laboute 1976: 96 (New Caledonia); Lee 1986: 170, pl. 3, fig. 18 (Taiwan); Lee in Shen 1993: 372, pl. 108 (Taiwan).

Pentapodus microdon (non Bleeker). - Fourmanoir and Laboute 1976: 96 (New Caledonia).

Pentapodus sp. - Randall *et al.* 1990: 205 (Great Barrier Reef, Australia).

Type material. HOLOTYPE - NTM S.10919-001, 153.7 mm SL, male, American Samoa, Tutuila Island (14° 18'S, 170° 42'W), Fagatogo market, R.C. Wass, 22 September 1982. PARATYPES (21 specimens) - AMS I.16010-001, 147.3 mm SL, male, Australia, Queensland, Broadhurst Reef (18° 58'S, 147° 41'E), G. Coates, 1971; AMS I.17466-021, 108.8 mm SL, female, New Caledonia, Puetege Reef (22° 22'S, 167° 08'E), 6-25m, spear, G.R. Allen and W.A. Starck II, 15 June



Fig. 1. *Pentapodus aureofasciatus* n. sp., paratype (BPBM 27118), 156 mm SL, New Caledonia (photo: J.E. Randall).

1973; AMS I.20584-003, 2:86.0-93.5 mm SL, Australia, Queensland, One Tree Island (23° 30'S, 152° 05'E), 15 m, explosive. B.C. Russell and party, 24 November 1973; ASIZP 055680, 140.8 mm SL, Taiwan, Hengchun (22° 03'N, 120° 45'E), 19 February 1981; BMNH 1858.4.29:483, 131.3 mm SL, Indonesia, Ambon (3°41'S, 128°10'E), BPBM 20868, 125.5 mm SL, female, Fiji, Bega (18° 25'S, 178° 02'E) between Stuart Island and Yanuea Island, spear, B. Carlson, 16 January 1974; BPBM 27118, 156.0 mm SL, New Caledonia, N.E. coast, off Solitaire Island (21° 48'S, 166° 38'E), 40 m, hook and line, J.E. Randall, 11 January 1979; BPBM 27838, 99.4 mm SL, male, Australia, Queensland, Lizard Island (14° 39'S, 145° 27'E), Granite Bluff, 18 m, spear, J.E. Randall, 20 September 1981; BPBM 29186, 155.4 mm SL, Tonga, Vava'u Group, W. side of Luamoko Island (18° 21'S, 174° 06'W), 25 m, spear, J.E. Randall, 16 March 1983; BPBM 30250, 137.5 mm SL, male, Papua New Guinea, Port Moresby, Bootless Inlet, seaward side of Horseshoe Reef (9° 29'S, 147° 15'E), 36 m, spear, P.L. Colin, 23 January 1984; NTM S.10728-001, 3:83.6-110.3 mm SL, Australia, Queensland, Lizard Island (14° 39'S, 145° 27'E), North Point Reef, 15-18 m, spear, B.C. Russell, 5 February 1983; QM I.16606, 142.9 mm SL, Australia, Queensland, 6-8 miles E. of Mooloolaba (26° 46'S, 153° 18'E), 27-36 m, J. Johnson, 2 July 1979; QM I.16609, 118.5 mm SL, Australia, Queensland, Lizard Island (14° 39'S, 145° 27'E), hook and line, E. Grant, 13 July 1979; QM I.19753, 173.4 mm SL, Australia, Queensland, off Cape Moreton, Flinders Reef, (26° 59'S, 153° 30'E), hook and line, E. Grant, 12 September 1982; QM I.20333, 158.0 mm SL, Australia, Queensland, S. of Noosa, 5 km E. of Peregian

Beach (26° 29'S, 153° 08'E), 25 m, hook and line, E. Grant, 3 July 1983; WAM P.28095-001, 141.7 mm SL, American Samoa, Tutuila Island, Taema Bank (14°19'18"S, 170°39'13"W), 28 m, spear, R.C. Wass, 3 May 1977; URM P11790, 126.0 mm SL, Japan, Ryukyu Is, Okinawa Island (26° 31'N, 127° 59'E), 13 September 1985; URM P20053, 129.0 mm SL, Japan, Ryukyu Is, Okinawa Island (26° 31'N, 127° 59'E), 16 November 1988.

Diagnosis. Snout length about equal to diameter of eye; scales on top head not reaching forward to a line between posterior nostrils; suborbital naked or with a small patch of scales beneath the eye; lower limb of preopercle with 2 or 3 scale rows; lateral-line scales 42 to 48 (usually 46 or 47); pectoral-fin rays 15 to 17; pelvic fins moderately long, reaching to or just short of level

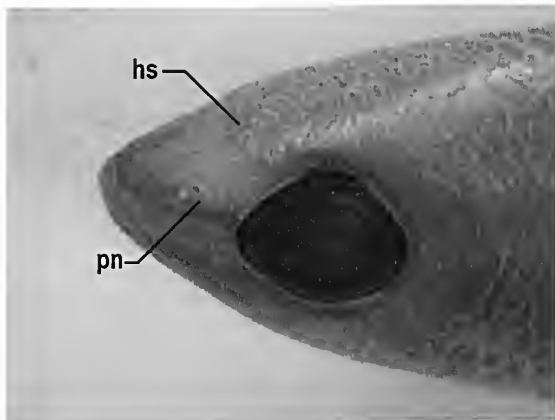


Fig. 2. *Pentapodus aureofasciatus* n. sp., holotype, anterior dorsolateral aspect of head showing extent of scales on top of head (hs), not reaching forward to a line between posterior nostrils (pn).

of anus; caudal fin forked, lobes more or less equal in length (Fig. 1).

Description. Dorsal-fin rays X,9; anal-fin rays III,7; pectoral-fin rays 17 (15-17); pelvic-fin rays I,5; lateral-line scales 47 (42-48); transverse scale rows above lateral-line 3 (2.5-3); transverse scale rows below lateral-line 11 (11-16); transverse scale rows on preopercle 4+3 (4+2 – 7+3).

Depth 4.0 (3.4-4.2) in SL; head 3.5 (3.4-3.8) in SL; snout 3.4 (3.2-3.8) in head; eye 3.2 (2.8-3.6) in head; interorbital width 3.6 (3.2-4.4) in head; suborbital depth 11.0 (8.5-12.6) in head; eye 1.0 (0.7-1.1) in snout; suborbital depth 3.4 (2.5-4.4) in eye; peduncle depth 1.6 (1.2-1.7) in peduncle length; dorsal-fin length 1.9 (1.8-2.0) in SL; fourth or fifth dorsal spine longest, 1.7 (1.6-2.8) times length of first dorsal spine; sixth or seventh dorsal ray longest, 1.0 (0.8-1.0) times length of longest dorsal spine; anal-fin length 6.4 (6.1-7.2) in SL; first anal spine 1.9 (1.6-2.6) in length of second anal spine; second anal spine 1.2 (1.1-1.4) in length of third anal spine.

Maxilla reaching almost to or just behind anterior margin of eye; pelvic fins reaching to or just short of vent; scales on top of head not reaching forward to a line between posterior nostrils (Fig. 2); suborbital naked (small patch of scales just below eye present in specimens from Tonga and Samoa); lower limb of preopercle scaly; 1-3 pairs of small to moderately large canines in front of upper jaw; a pair of large canines in front of lower jaw.

Colour in alcohol. Body pale brown, lighter below. Dusky brown band from tip of snout to middle of anterior margin of eye; a second narrower dusky band parallel to first, from upper lip to anteroventral margin of eye (bands on snout faded or lacking in some specimens).

Life colours. Body pale blue, whitish on ventral surface; narrow pale yellow band extending along back above lateral-line from behind eye to posterior end of dorsal fin (faded or absent in larger specimens); second broader pale yellow band extending mid-laterally along body from behind eye to caudal peduncle (fading beneath soft dorsal fin in larger specimens); blue band from tip of snout to middle of anterior margin of eye; second blue band from upper lip, passing under anteroventral margin of eye and fading on preopercle; interspace between bands on snout pale yellow; pearly blue band on ventral surface from behind pelvic fins to caudal peduncle present in larger specimens; fins pale pinkish, caudal fin deep pink in specimens from Taiwan, Okinawa, New Caledonia and Tonga; the specimen from Tonga (BPBM 29186) with outer portion of upper lobe of caudal fin blackish.

Juveniles bright blue, with two yellow lateral bands: upper one extending from behind eye to upper part of

caudal peduncle on either side of body, this band joining on top of head above anterior margin of eye; lower one running mid-laterally from upper lip through lower margin of eye to caudal peduncle. Randall *et al.* (1990: 205) illustrate the adult and juvenile colour form of this species.

Remarks. In general body form *Pentapodus aureofasciatus* resembles *P. trivittatus* (Bloch) but differs in colour, notably in lacking dusky stripes along the sides and a dark bar at the base of the pectoral fin. It is similarly coloured to *P. caninus*, but differs in the extent of the scaled area on top of the head, which does not reach forward to a line between posterior nostrils, and lacks a naked wedge-shaped medial notch. The caudal fin also is forked rather than falcate.

This species has been previously misidentified as *P. nagasakiensis* (Fourmanoir and Laboute 1976; Lee 1986; Lee in Shen 1993) or *P. microdon* (Fourmanoir and Laboute 1976). Randall *et al.* (1990) illustrated it as *Pentapodus* sp.

Australian specimens of *P. aureofasciatus* lacked banding on the snout, although this may be an artifact of preservation. Bruce Carlson (pers. com.) reports that some individuals of this species in Fiji have the upper lobe of the caudal fin blackish, similar to that of the Tonga specimen, and this may be a sexual colour pattern.

Local name in Samoa is *Tivao-sugale* (R.C. Wass pers. com.).

Distribution. Widely distributed, from the Ryukyu Islands, Taiwan, Indonesia (Ambon), Papua New Guinea (Port Moresby), north-eastern Australia (Queensland to northern New South Wales), New Caledonia, Fiji, Tonga and Samoa.

Etymology. Named *aureofasciatus* in reference to the distinctive yellow mid-lateral band of this fish.

Key to the species of *Pentapodus*

1. a Caudal fin with upper rays or upper and lower rays produced into long trailing filaments 2
 - b Caudal fin without long filamentous extensions, lobes pointed, sharply pointed, or falcate 4
2. a Upper and lower lobes of caudal fin produced into long trailing filaments; lower limb of preopercle scaly, at least posteriorly; lateral-line scales 50 to 56 (usually 52 to 54) (Philippines, Indonesia, north-western Australia) *P. emeryii*
 - b Upper lobe of caudal fin only produced into long trailing filament; lower limb of preopercle naked; lateral-line scales 46 to 50 3
3. a Three dusky stripes (blue in life) on snout; first from eye to tip of snout, second from eye across snout in front of nostrils, third joining eyes behind nostrils (north-eastern Australia, Papua New Guinea, Solomon Is) *P. paradisens*

- b Two dusky stripes (blue in life) on snout; first from eye to middle of upper lip, second from eye to tip of snout; no stripe joining eyes (Philippines, Indo-Malay Archipelago) *P. setosus*
4. a Head scales reaching forward dorsally to, or in front of, a line between posterior nostrils 5
- b Head scales reaching forward dorsally to a line between anterior margin of eyes, or almost to posterior nostrils 7
5. a Head scales reaching to a line between posterior and anterior nostrils; scaled area between nostrils rectilinear (Philippines, Indo-Malay Archipelago) *P. bifasciatus*
- b Head scales extending to, or in front of, a line between posterior nostrils; scaled area between nostrils with a naked, medial wedge-shaped notch anteriorly 6
6. a Lower limb of preopercle scaly; caudal fin forked, lobes falcate, upper lobe usually longer than lower (Philippines, Indo-Malay Archipelago) *P. caninus*
- b Lower limb of preopercle naked; caudal fin forked, lobes pointed, more or less equal in length (south-western Australia) *P. vitta*
7. a Lower limb of preopercle naked 8
- b Lower limb of preopercle scaly 9
8. a Snout length greater than eye diameter; body moderately deep (depth 3.0 to 3.7 in SL); black spot on caudal peduncle (north-western Australia) *P. porosus*
- b Snout length equal to or less than eye diameter; body slender (depth 3.9 to 4.5 in SL); no spot on caudal peduncle (Japan, S. China Sea, northern Australia) *P. nagasakiensis*
9. a Body pale with 3 dusky stripes (brown in life) along sides; dark bar at base of pectoral fin (Indo-Malay Archipelago, New Guinea, Solomon Is) *P. trivittatus*
- b Body colour not as above; no dark bar at base of pectoral fin *P. aureofasciatus* n. sp.

ACKNOWLEDGMENTS

I am grateful to the following persons and institutions for loan of specimens: J. Barry Hutchins (WAM), Jeffrey W. Johnson (QM), Sin-Che Lee (ASIZP), Mark A. McGrouther (AMS), John E. Randall (BPBM) and Tetsuo Yoshino (URM). Thanks are also due to Gerald R. Allen, E.M. Grant, Phillip C. Heemstra, Rudi H. Kuiter, John E. Randall, Roger C. Steene and Richard C. Wass for providing specimens and/or photographs. Helen K. Larson kindly provided comments on the manuscript. Part of this work was undertaken during tenure of a CSIRO Postdoctoral Fellowship at the National Museum of Natural History, Smithsonian Institution (USNM), and I am grateful to Victor G. Springer for making available to me the fish collection and facilities at the USNM.

REFERENCES

- Fourmanoir, P. and Laboute, P. 1976. *Poissons des mers tropicales Nouvelle Calédonie – Nouvelles Hébrides*. Papete: Les Éditions du Pacifique.
- Fowler, H.W. 1933. Contributions to the biology of the Philippine Archipelago and adjacent regions. *Bulletin of the United States National Museum* 100 12: 1-465.
- Lee, S.-C. 1986. Fishes of the family Nemipteridae (Teleostei: Percoidae) of Taiwan. *Bulletin of the Institute of Zoology, Academia Sinica* 25(2): 161-175.
- Randall, J.E., Allen, G.R. and Steene, R.C. 1990. *Fishes of the Great Barrier Reef and Coral Sea*. Honolulu: University of Hawaii Press.
- Russell, B.C. 1986. Review of the western Indian Ocean species of *Nemipterus* Swainson 1839, with description of a new species. *Senckenbergiana Biologia* 67: 19-35.
- Russell, B.C. 1990. *FAO species catalogue. Vol. 12 Nemipterid fishes of the world*. FAO Fisheries Synopsis No. 125, Rome: FAO.
- Shen, S.C. (ed.). 1993. *Fishes of Taiwan*. Taipei: National Taiwan University.
- Weber, M. and de Beaufort, L.F. 1936. *The Fishes of the Indo-Australian Archipelago*, Vol. 7. Leiden: E.J. Brill.

Accepted 12 November 2001

New genus and species of Chrysopetalidae (Polychaeta) from hydrothermal vents (south-western Pacific)

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ABSTRACT

Thrausmatos dieteri new genus, new species, is described from hydrothermal vents from the North Fiji Back Arc Basin and from a cold seep, Lihir Island Fore Arc Basin, New Ireland, Papua New Guinea. *Thrausmatos* n. gen. is characterised by a small quadrate prostomium, anteriorly inserted median antenna, palps that are distally retractile, a single, paleate, ornate, notosetal fan with median fascicle absent and long, slender dorsal cirri. Neuropodia on all specimens possess long, falcigerous neurosetae with minute bifid tips and also a small distinct fascicle of highly serrate spinigers, that are probably epitokous in function, and prominent ventral glandular pads.

KEYWORDS: Polychaeta, Chrysopetalidae, new genus and species, *Thrausmatos dieteri*, hydrothermal vents, North Fiji Back Arc Basin, cold seep, Lihir Island Fore Arc Basin, Papua New Guinea.

INTRODUCTION

Eighteen polychaete families have been reported from hydrothermal vents from the eastern and western Pacific (Tunnicliffe *et al.* 1998). Three of these families, Alvinellidae, Polynoidae and Ampharetidae, have been listed from south-western Pacific sites in the Lau and North Fiji Basins (Desbruyères *et al.* 1994).

The new genus and species described herein is the first record of the family Chrysopetalidae collected from hydrothermal vents and cold seeps. Of the eleven genera so far described for the Chrysopetalidae (Watson Russell 2000b), four have been reported from deep-sea oxic-anoxic interfaces. Two of these genera possess paleate notosetae - *Arichlidon reysi* Watson Russell, 1998, from soupy muds at 3,947 m in the eastern Mediterranean and *Strepternos didymopyton* Watson Russell, 1991, from 'wild' wood debris and experimental wooden panels at 3,995 m in the western Atlantic. The other two genera possess spinose notosetae - *Dysponetus* cf. *gracilis* at 3,000 m from xenophyophores (giant sediment-agglutinating protozoans) and the caldera floor of sea-mounts of the eastern Pacific (material kindly lent by Lisa Levin and examined by author), and an unnamed taxon close to *Vigorniella* Kisseleva, 1992, found infesting a whale skeleton in deep waters off southern California (Leslie Harris, pers. comm.).

Thrausmatos dieteri n. gen., n.sp., a paleate species, was retrieved from a hydrothermal vent area off North Fiji in depths to 2,002 m. The same species was also found in depths of 1,577 m at a cold seep site, south of

Lihir, Papua New Guinea. Both habitats were dominated by a speciose molluscan fauna.

The new chrysopetalid material, collected between 1995-98, was sampled by a two-shovelled, video-equipped grab covering an area of 2 m² with a penetration depth of 0.7 m into the sediment, controlled from onboard the R/V *Sonne*. Expeditions SONNE 133 and 134 were funded by the German Federal Ministry of Research while SONNE 99 was a French-German co-operation.

Specimens from all sites are in a fragmented state. The holotype is described from a long anterior end and the posterior end from paratypes. Setal terminology follows that of Watson Russell (1991).

Material examined is in the following institutions: Senckenburg Museum, Frankfurt (SMF); Northern Territory Museum (NTM).

SYSTEMATICS

Family Chrysopetalidae Ehlers, 1864 Genus *Thrausmatos* gen. nov.

Type species. *Thrausmatos dieteri* sp. nov. Type by original designation.

Diagnosis. Relatively long, rectangular body form with tapered anterior and posterior ends; mid-body segments easily fragment. Notopodia along body with symmetrical, broad, paleate notosetae in a single fan and long, slender dorsal cirri. Prostomium quadrate, small, with or without eye pigment; median antenna

inserts on anterior edge of prostomium. Palps ovoid with retractile, subulate tips; oval caruncle present. First two segments with four pairs of tentacular cirri; paleal notosetae first present on segment 2. Notosetae of mid-body segments comprise lateral and main paleal fascicles; discrete median fascicle absent. Single main fan with lateral, middle and medial group paleae. Compound neurosetae of neuropodia with long, slender, minutely serrate, falcigerous blades with minute bifid tips; additional neurosetal fascicle present, comprising short shafts and highly serrate spinigerous blades. Prominent glandular pads present along body on ventrum at base of neuropodia.

Remarks. Characters important at the generic level in chrysopetalids include numbers of pairs of tentacular cirri and presence/absence of aciculae and setae of the anterior two or three segments; shape, size and details of the prostomium, its appendages and nuchal organ; insertion pattern of the notosetal fascicle and main paleae shape, ornamentation and numbers of internal and external longitudinal ribs, and structure of the pygidium.

The author has observed that all species within a paleate chrysopetalid genus exhibit consistency in the structure of the anterior segments and notosetal type. Those species with predominantly notosetal spines belong at the moment to the single genus *Dysponetus*, currently under review by Thomas Dahlgren. Four patterns are currently described for the structure of the anterior segments and a range of notosetal types within the eight nominal species of *Dysponetus*, indicating the genus is polymorphic.

Thrausmatos n. gen. is compared with the genus *Strepternos* on the basis of similar notosetal types, but the pattern of tentacular cirri of the anterior end is different (Table 1). *Thrausmatos* n. gen. is also compared with *Chrysopetalum*, *Acanthopale* and the species *Dysponetus caecus* (based on *Chrysopetalum caecum* (= *Dysponetus*)) described and figured in detail by Laubier (1968) and Dahlgren and Pleijel (1998) (Table 1). They are selected primarily for the similarity of two pairs of tentacular cirri on segment 1, and two pairs of tentacular cirri plus notosetae present on segment 2. *Acanthopale* additionally has neurosetae on segment 2. *Thrausmatos* n. gen. also shares with *Chrysopetalum* and *Acanthopale* the presence of a non-retractile caruncle.

Red pigmented granulations at the bases of antennal, tentacular and setigerous cirri, as well as mid-caruncle, are seen in *Thrausmatos* n. gen., and also occur in some species of *Chrysopetalum* (pers. obs.). The notosetal insertion patterns and main setal types of all four genera are, however, distinctly different (Table 1).

Additional remarks are presented after the species description.

Etymology. The generic name, *Thrausmatos*, is from the Greek, meaning easily broken, fragmented piece. Gender neuter.

Thrausmatos dieteri sp. nov.

(Figs 1-5)

Type material. HOLOTYPE - SMF 10390, south-western Pacific, North Fiji Basin, 16° 59.486' S, 173° 54.910' E, Station 99 GTVA, coll. RV *Sonne* Cruise So-134 (Hyflflux II), vent. Mussel Hill Area A, 1,999 m, 3 September 1998, holotype anterior end 68 segments, width of anterior segments 0.7 mm, mid-body widest point 2.8 mm, length 10 mm. PARATYPES - SMF 10391, same locality as holotype, many fragments including 9 anterior and 2 posterior ends; NTMW017243, 2 anterior ends plus fragments.

Additional material. SMF 10392, south-western Pacific, North Fiji Back Arc Basin, 16° 59.44' S, 173° 54.82' E, Station 93 GTV, vent. LHOS area, 1,984 m, coll. Cruise So-99 (Hyflflux I), 23 January 1995, 2 fragments in poor condition; SMF 10393, 16° 59.426' S, 173° 54.819' E, Station 35 GTVA, vent. LHOS, Area A, 2,002 m, coll. Cruise So-134 (Hyflflux II), 20 August 1998, many fragments including 13 anterior and 2 posterior ends; SMF 10394, 16° 59.447' S, 173° 54.937' E, Station 66 GTVA, vent. LHOS Area A, 1,997 m, Cruise So-134 (Hyflflux II), 25 August 1998, 2 fragments; SMF 10395, Papua New Guinea, New Ireland, south of Lihir Island, Fore Arc Basin, 3° 19.352' S, 152° 35.462' E, Station 44 GTVA, cold seep, Mussel Cliff, 1,577 m, Cruise So-133 (Edison II), 26 July 1998, 2 fragments in poor condition.

Description. Based on holotype. Anterior mid-body fragment rectangular, long, tapered anteriorly, broadest at mid body; segments easily fragment. Segments number 68. Pale gold coloured paleae fans, sometimes flecked with brown scale, in transverse row in notopodium imbricating over dorsum. Neuropodia extending out beyond notopodia with long neurosetal fascicles (Fig. 1A). Brown, globular occlusions present in body.

Prostomium small, quadrate, compressed between anterior segments. Eyes not visible. Ovoid caruncle with red pigment spots posterior to prostomium.

Subulate median antenna same shape as lateral antennae, with very short ceratophore (only visible on high magnification), inserting medially on anterior edge of prostomium just dorsally to two similar sized lateral antennae, inserting on antero-ventral margin of prostomium. Prostomial cirri with filiform tips. Two ovoid palps inserting on ventral edge of prostomium both with subulate, filiform tips everted.

Segments 1 and 2 reduced, fused in part to prostomium, with four pairs tentacular cirri, same shape and length as dorsal cirri of third segment, anteriorly directed. First segment achaetous, second segment with

Table 1. Comparison of characters between *Thrausmatos* and other chrysopetalid taxa. ¹ Refer to text for discussion. ² Paleae defined as having internal longitudinal ribs.

Characters	<i>Thrausmatos</i>	<i>Chrysopetalum</i>	<i>Acauthopale</i>	<i>Dysponetus caecus</i>	<i>Strepternos</i>
Segment 2	2 pairs tentacular cirri, notosetae	2 pairs tentacular cirri, notosetae	2 pairs tentacular cirri, notosetae, neurosetae	2 pairs tentacular cirri, notosetae	1 pair dorsal cirri, notosetae, neurosetae; ventral cirri absent
Anterior segments retractile/non retractile in conjunction with nuchal organ	Non-retractile	Non-retractile	Non-retractile	Non-retractile	Retractile
Shape of prostomium	Quadrate, small	Spherical, medium size	Spherical, medium size	Quadrate, small	Oval, very small
Shape & position of median antenna on prostomium	Subulate, relatively long; anterior edge	Ovoid to fusiform, short; between anterior pair of eyes; anterodorsal	Subulate, medium size; just anterior to anterior pair of eyes; anterior edge	Fusiform, short; anterodorsal edge	Ovate, medium size; mid-dorsal
Pulp shape; distinct palpophore, present or absent ¹	Ovoid base with distal, filiform process; absent	Cylindrical, elongate; absent	Cylindrical, very elongate; present (San Martin 1986)	Slender, very elongate; present (Dahlgren and Pleijel 1995)	Ovoid, elongate; absent
Distal part of palps retractile	Distal, filiform process retractile in part	Postulated by Racovitza (1896)	Present ?	Absent	Absent
Nuchal organ type	Discrete, ovoid caruncle; non retractile	Discrete, ovoid caruncle; non retractile	Discrete, ovoid caruncle; non retractile	Ciliary tufts	Semicircular lobe; retractile
Pygidial structure	Medial projection; anal cirri?	Quadrate pygidium; 2 anal cirri	Medial projection; 2 anal cirri	Medial projection	Medial projection
Notosetal types; adult, mid-body ²	All paleae	Predominantly paleae; some spines	Predominantly paleae	All spines	All paleae
Insertion pattern of main notosetal fan	Paleae layered in single row in single fan	Clusters of paleae layered in single row; originating from multiple insertion points	Paleae originate from discrete anterior & posterior rows	Spines inserting in radiating tufts	Paleae layered in single row in double fan
Main group notosetal shape; numbers of internal and external longitudinal ribs	Long, symmetrical with broad tips; 10-20 internal ribs, 1-12 external raised ribs	Slender, blade-like, asymmetrical and symmetrical; 3-12 internal ribs; external granules; external ribs absent	Slender, curved, 'rose-bush' like with 2 rows of triangular spines; 3-5 internal ribs; external ribs absent	Long, slender with 2 rows of short spines; internal & external ribs absent	Long, symmetrical with broad tips; 11-21 internal ribs, 2-3 external raised ribs
Median notosetal fascicle, present or absent	Absent	Present; short, blade-like paleae with 1 external rib (external rib absent in 1 species)	Absent	Absent	Absent
Compound falcigerous neurosetal types; adult, mid-body	Long to medium length falcigerous blades, minutely serrated with bifid tips	Medium to short length falcigerous blades, serrate with slender, unidentate tips	Medium length falcigerous blades, serrate, bifid tips	Long to medium length falcigerous blades, finely serrate, uni-bidentate	Medium to short length falcigerous blades, serrate, with thick unidentate tips

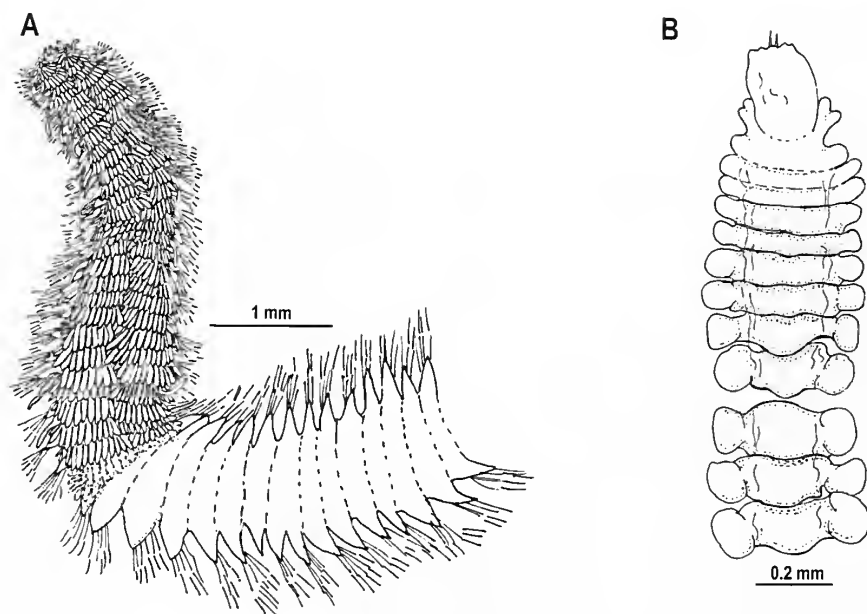


Fig. 1. A, *Thrausmatos dieteri*, n. gen. n. sp., holotype SMF 10390, anterior end of 68 segments, dorsal view; B, paratype SMF 10391, anterior end figured in part with everted proboscis and stylet tips, ventral view.

several small paleal notosetae only. Third segment biramous, partly fused to segments 1 and 2, dorsally abutting caruncle; dorsal cirri, paleal notosetae, ventral cirri and falcigerous neurosetae present. Fourth and subsequent segments as third.

Mid-body notopodia with lateral and main paleal fascicles. Single main fan with lateral, middle and medial group paleae (Fig. 2A); dorsal cirri very long and slender, extending out beyond paleal fan. Neuropodia with subacicular fascicle of heterogomph falcigerous neurosetae of graded lengths, originating below robust neuroaciculae; ventral cirri slender, extending just past tip of neuropodia. Distinct small fascicle of spinigers present superior to overlying, ventral acicula and falcigerous fascicle; present from setiger 2 (segment 4). Glandular ventral pads present.

Additional information from paratype and other material. Paleal and neurosetal counts are based on segments 2 and 22 of an anterior mid-body fragment and posterior-most segments of a posterior fragment from the paratypes (SMF 10391).

Segment 2 (setiger 1) with 2-3 short paleae with 12 or 13 ribs and 3 or 4 faintly raised ribs (Fig. 2F). Mid-body setigers with notosetae comprising 4 or 5 slender, serrate-margined lateral paleae with 2-6 ribs; raised ribs absent (Fig. 2B). Main paleae number up to 30; including 2-3 subunit 1 shorter palea, originating immediately above dorsal acicula, with 10 or 11 ribs and 2 weakly raised ribs (Fig. 2B). Main paleae with

13-17 ribs including up to 12 raised ribs of which one major rib and 2 or 3 others extend full length of palea (Fig. 2C). Most medial main paleae, numbering 2-4, slightly broader and asymmetrical with 19 or 20 ribs and 3-4 weakly raised ribs (Fig. 2E). Slightly misshapen, shorter palea with 13 or 14 ribs including 2 or 3 weakly raised, sometimes present within the fan in mid-lateral position (Fig. 2D). Paleae of posterior-most notopodia same shape, more slender, pointed, than those of mid-body. Lateral paleae with serrated margins, 0-1 internal longitudinal rib; largest main paleae with up to 9 ribs with 0 or 1 raised rib. All main paleae symmetrical with small elevated apices and clearly serrate margins especially on anterior $\frac{2}{3}$ of palea.

Mid-body neuropodia with superior group of 7 falcigers with long, slim shafts and very long blades; below these a group of 12-16 falcigers with long blades (Figs 3D-E). Mid group composed of about 20 falcigers with medium sized blades graduating in length to inferior group of 8-10 falcigers with shorter-length blades (Figs 3F-I). Small, short bladed spiniger present within posterior 10 neuropodia in mid-posterior position within falcigerous fascicle.

Distal tips of all neurosetae minutely bifid; blades appear smooth and unserrated on low power; on high power very fine denticulation visible along length of blade (Fig. 3C). Neuropodia from segment 4 with small, discrete fascicle of spinigers numbering 8-12; overlying ventral acicula superior to falcigerous fascicle.

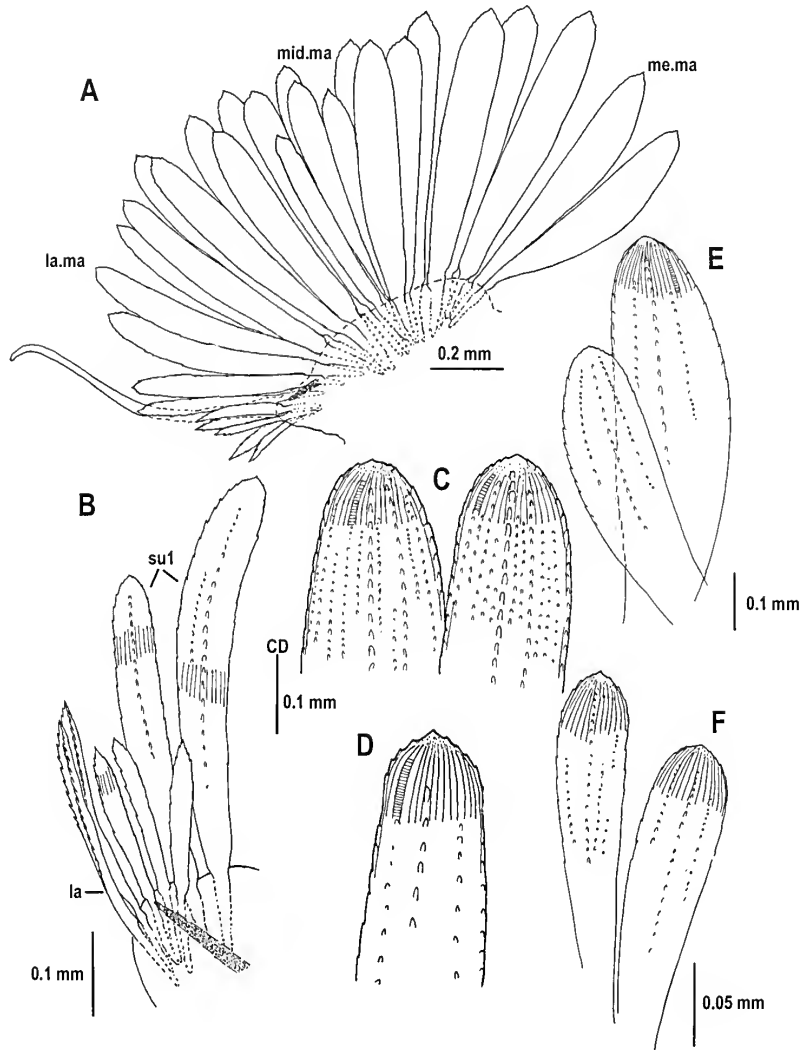


Fig. 2. *Thrausmatos dieteri*, A-F, paratype SMF 10391: A, notopodial fan of segment 22, middle body, anterior view; B, lateral paleae (la), subunit 1 paleae (su1); C, detail of two middle main paleae; D, detail of slightly misshapen main palea (see in lateral mid position of fan, 2A); E, detail of two medial-most main paleae. F, detail of two smaller paleae from segment 2. Abbreviations: la = lateral paleae, la. ma = lateral main paleae, mid. ma = middle main paleae, me. ma = medial main paleae.

Heterogomph spinigers composed of short shafts with short to medium length, basally serrate blades attenuating to fine whip-like tips (Fig. 3A,B,J).

Remarks and discussion. *Fragmentation.* Material of *Thrausmatos dieteri* examined from all sites was composed of fragmented anterior, mid and posterior sections of adults. A vial with the largest anterior end comprised more than 90 segments (SMF 10393). Fragmentation could be due in part to collecting and screening methods. However, the absence of any entire individuals plus the paucity of posterior ends is probably

due to the inherent ability of the worm to fragment easily. Examination of the ventra shows the first 5-10 segments to be narrower, with the division between these segments in a straight line, whereas the following segments are broader and medially curved. These segments break apart when handled with forceps and their shape and the way they fit together like jig-saw pieces suggests fragmentation under duress may be a behavioural strategy of the worm *in situ* (Fig. 1B). This state is also seen in other chrysopetalid genera, especially some species of *Paleanotus* and *Treptopale* (pers. obs.).

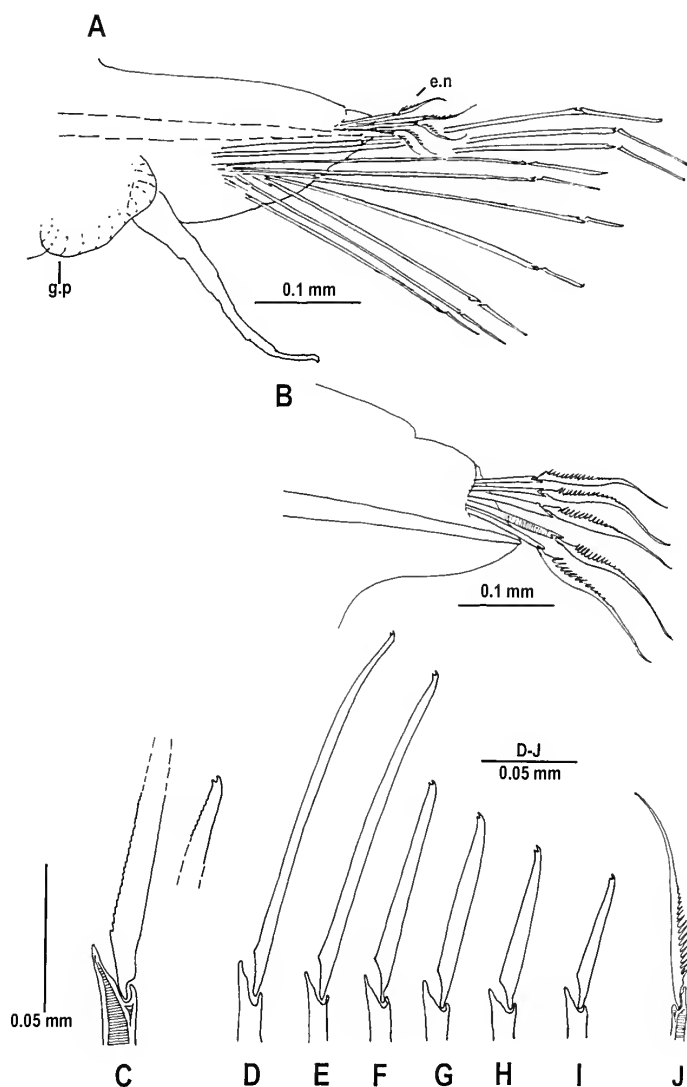


Fig. 3. *Thrausmatos dieteri*, paratype SMF 10391: A, neuropodium of segment 22, posterior view; B, detail of spinigerous fascicle; C, detail of fine denticulation on proximal and distal parts of falcigerous blade; D, E, superior neurosetal falcigers; F-I, mid and inferior position neurosetal falcigers; J, superior-most position epitokous ? neurosetal spiniger. Abbreviations: e.n. = epitokous neurosetae, g.p. = glandular pad.

Tentacular cirri. *Thrausmatos dieteri* has segments 1 and 2 with two pairs of tentacular cirri on each segment. The tentacular cirri are the same shape and length as dorsal cirri of the third segment. The first segment is achaetous, the second segment has several small palcal notosetae only (Fig. 4A-D).

Segments 1 and 2 of all chrysopetalids are to a greater or lesser degree fused, directed anteriorly and lateral to the prostomium and nuchal organ (which when present may be retractile). These characters are also described for *Vigtorniella* Kissleva, 1992, the only chrysopetalid genus not examined by the author.

Pleijel and Dahlgren (1998) regarded the anterior segment cirri as tentacular cirri if they were enlarged or prolonged compared to the dorsal and ventral cirri of the following segments. Based on this criterion, Pleijel and Dahlgren (1998) discounted the occurrence of dorsal tentacular cirri but considered ventral cirri as tentacular, in the two chrysopetalid genera and species they examined.

The author has observed that both dorsal and ventral cirri of the anterior two segments (and in some cases segment 3) to be distinctly longer, a little longer and the same size compared to the cirri of following

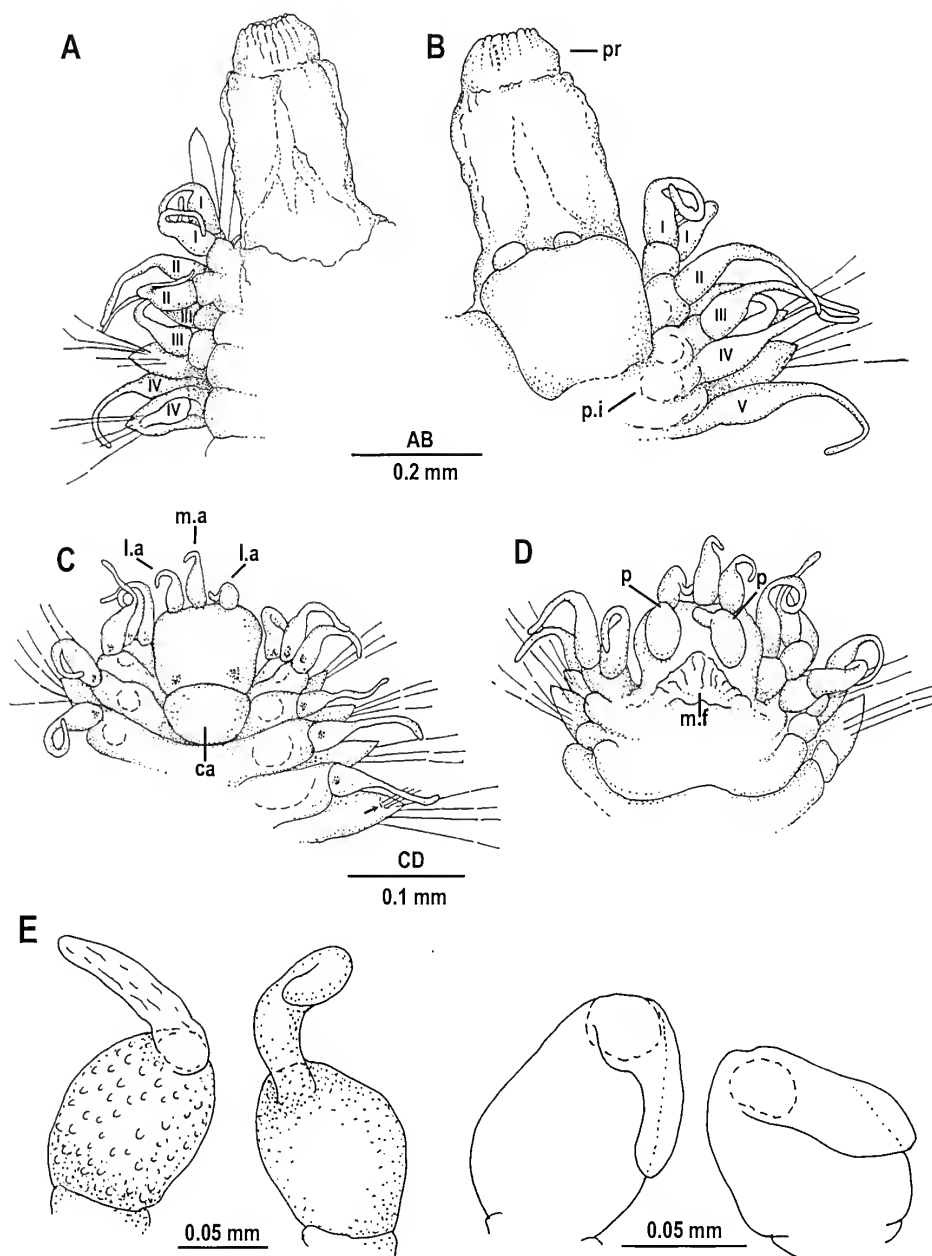


Fig. 4. Various specimens of *Thrausmatos dieteri* from lot SMF 10393: **A, B**, specimen 1, anterior end with proboscis extended, right side figured only. **A**, ventral view; **B**, dorsal view; **C, D**, specimen 2, **C**, dorsal view; **D**, ventral view, anterior end of 11 segments; **E**, details of two sets of palps (specimens 3 and 4). Abbreviations: **I** = segment 1 with 2 pairs of tentacular cirri only; **II** = segment 2 with 2 pairs of tentacular cirri and notopaleal fascicles; **III** = segment 3, notopodia with dorsal cirri, notopaleal fascicles and neuropodia with neurosetae, ventral cirri; **IV** = segment 4 and subsequent segments same as segment 3; **ca** = caruncle; **la** = lateral antennae; **m.a.** = median antenna; **m.f.** = mouth fold; **p** = palps; **p.i.** = paleae insertion; **pr** = proboscis.

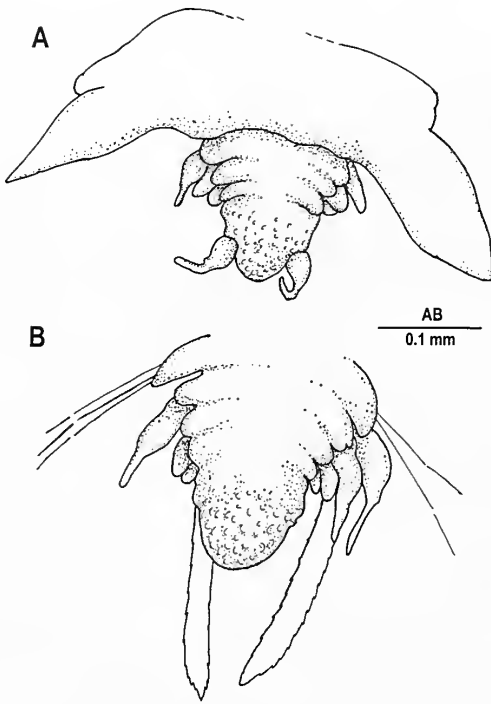


Fig. 5. *Thrausmatos dieteri*: A, paratype SMF 10391, regenerated posterior end with pygidium with 2 anal cirri; B, SMF 10393, pygidium with anal cone, anal cirri absent.

segments, across a large number of chrysopetalid genera and species. Regardless of the presence of a caruncle or nuchal fold, the first segmental line discernible on the dorsum in the majority of chrysopetalids is between that of segments 3 and 4, posterior to the mouth opening. For the purpose of simplicity I refer to cirri on the anterior two fused segments as 'tentacular cirri'.

Eyes. The aggregation of red pigment spots on the prostomium that are referred to as 'eycs' in *Thrausmatos dieteri* are sometimes visible (Fig. 4C) and sometimes not (Fig. 4B). Very similar eye spots are present in the post-larvae and juveniles and absent in the adults of the deep-sea genus *Strepternos* (Watson Russell 1997). Whether these pigment spots in *Thrausmatos* and *Strepternos* are true eyes and whether their lack is due to preservation techniques or the eyes are atrophied, is unclear and warrants further investigation.

Palps. *Thrausmatos dieteri* possesses palps composed of an ovoid base with large circular cells and a distal filiform subulate process with filiform, longitudinal cells. It appears that this latter structure may be at least partly retractile within the broad ovoid base (Fig. 4E). Proximally to the ovoid base is sometimes seen a very small fold but not a structure that could be termed a palpophore (Fig. 4E).

Palps with a palpophore have been described for *Dysponetus caecus* (Laubier 1968: fig. 1A; Dahlgren 1995: fig. 3A) and *Acanthopale perkinsi* (San Martín 1986: fig. 2). The palpostyle in these examples are not retractile within the palpophore.

In his detailed anatomical study of *Chrysopetalum debile*, Racovitza (1896) describes a shallow depression at the distal ends of the palps and suggests these tips are retractile – 'L'extrémité en est très retractile, ...' (p. 211) and 'Cette région est probablement invaginable ...' (p. 213).

The author has examined many individuals of *Chrysopetalum* species and *Acanthopale perkinsi*, and has observed the palps in all these species to have a slight distal depression with slight contraction in this area, but with no additional retractile process visible. The palps are situated on bases that do not appear to be discrete palpophores but are rather homologous with the basal sections of the segments, seen in ventral view, that are posterior to, and support, the distinct tentaculophores and cirrophores of the tentacular and dorsal and ventral cirri respectively.

Dahlgren and Pleijel (1998) code the palps as 'biarticulated' for *Chrysopetalum* and *Dysponetus*, based on the presence of palpophores and palpostyles, and infer similarity to those seen in nereid and some hesionid taxa. Perhaps it is more appropriate to describe the smaller distal process that nests within the larger base as palpostyles in accordance with the terminology of these authors. This is of interest following on Dahlgren's (2000) molecular study suggesting nereids are the sister group to the chrysopetalids.

Mouth flap and proboscis. A triangular mouth flap is present ventral and posterior to the palps in *Thrausmatos dieteri*. The proboscis is eversible with terminal papillae and two stylets (Figs 1B, 4A-B). The stylets were difficult to dissect out entire, owing to their small size, but were determined in one individual to consist of two slender, grooved structures partly visible through the everted pharynx wall and in another, the pointed tips were visible at the end of the proboscis. The stylet shape is typical of that seen in the majority of chrysopetalid genera. The character of a proboscis with a ring of terminal papillae is also seen in the chrysopetalids *Strepternos* and *Dysponetus caecus* (redescribed by Dahlgren and Pleijel 1995).

Notosetal patterns. *Thrausmatos dieteri* possesses a notosetal fascicle of only paleae, the main group inserting in a single continuous row (Fig. 2A). The long, symmetrical main paleae with ornamented ribs of *Thrausmatos*, are most like those seen in the main paleae of the deep-sea monotypic genus *Strepternos*, inserting in a single row but in two distinct fans. Main paleae of both genera possess a similar number of internal ribs and a discrete median paleae fascicle is absent.

Also of interest is a slightly misshapen main palea present in the main fan in a mid-lateral position,

occurring in *Thrausmatos* (Fig. 2D this paper) and also seen in *Strepternos* (Watson Russell 1991: fig. 3H). It appears there may be a similarity of developmental timing of the appearance and subsequent movement with maturity of this palea within the fan in both genera (Watson Russell 1997). Other morphological features of *Strepternos*, such as the tentacular cirri arrangement of segment 2, prostomial and nuchal organ features, and neurosetal types, are very different to those of *Thrausmatos* (Table 1).

Posterior end. Only four entire posterior ends of *Thrausmatos dieteri* were found in the samples. One posterior end, clearly regenerated, has a rounded to quadrate pygidium with two short anal cirri; two other pygidia possess a medial, glandular cone with no anal cirri present (Fig. 5A-B). The fourth pygidium has a quadrate structure dorsally with one longish cirrus present laterally, the other presumably broken, and a ventral glandular cone. More posterior ends are needed to clarify the pygidial structure.

Ventral rami are very long and pointed in posterior-body setigers. Glandular pads are prominent on the ventrum at the base of the neuropodia. In this part of the body these pads have a opening or a section of hyaline integument covering an opening. In the anterior mid-body the ventral pads are also evident but with no discernible opening. Less prominent glandular pads are seen in the same position in *Chrysopetalum* and *Paleanotus*. Their function is unknown. The integument of *Thrausmatos dieteri* is thicker and less transparent than that observed in other chrysopetalids. There are no recognizable structures, including eggs, which are usually clearly seen within mounted parapodia. However, small, golden rod-like structures with swollen tips were present.

Specialised spinigerous neurosetae. These are seen in all *Thrausmatos dieteri* specimens examined from all localities. Such setae were present on all anterior ends from segment 4 onwards and were present on posterior ends to within the last 10 segments. A posterior end of 25 segments, for example, had specialised neurosetae numbering 8-12 on each neuropodia of 18 segments, then were absent on the posterior most 7 segments (SMF 10391).

The position and structure of this specialized neurosetal fascicle is similar to that seen in two other chrysopetalid genera, *Arichlidon* and *Dysponetus*.

In *Arichlidon*, fascicles of long, attenuated spinigers are present between the 10th anterior and 5th posterior segments within an individual and number 3-14 per notopodium. These setae, however, were mainly present in ovigerous benthic and planktonic specimens and were interpreted as epitokous swimming setae (Watson Russell 2000a). *Dysponetus gracilis* has not been studied in detail but similar very long bladed spinigerous setae have been figured for

the species (Aguirrezabalaga *et al.* 1999). Such setae, numbering between 6-8, and present between setigers 9-22 in a 24 segmented entire individual of *Dysponetus cf. gracilis* from deep water, Bass Strait, Australia, have also been observed by the author.

The specialised setae in *Thrausmatos dieteri* are also spinigerous but are highly serrate and much shorter in length compared with those of the former genera and are also present in all individuals examined. It was not possible in this study to determine whether these setae are linked to gametogenic states but it is quite probable they are epitokous in function.

In conclusion, *Thrausmatos dieteri* is distinguished from all other chrysopetalid genera and species by its particular combination of the characters discussed above, plus the unique possession of palps with retractile filiform tips (Fig. 4D,E). The possession of a distinct neurosetal fascicle of highly serrate spinigers and the presence of prominent glandular ventral pads (Fig. 3A-I), while most probably linked to gametogenic change, appear at the present time to be unique to this genus.

Habitat and distribution. The following account of the hydrothermal vent and cold seep environments is from Jan Stecher (pers. comm.) and Schmidt *et al.* (in press). The sea floor bottom of the Back Arc Basin of the North Fiji sites consists of basalt with massive sulphides covered by some sediment and showed fissures, small cracks and hydrogen sulphide anomalies but with no smokers evident. The fauna is dominated by the bivalve mollusc *Bathymodiolus brevior* and the gastropod *Ifremaria nautelei*.

The sea floor of the Fore Arc Basin south of Lihir Island, New Ireland, consists of hydrocarbon enriched sediments, mainly indurated mud, with no fissures or cracks but showing a strong seep character. Mussel Cliff is dominated by at least three species of *Bathymodiolus* with an associated fauna of vestimentiferan tube worms, brittle stars and sea cucumbers. *Thrausmatos dieteri* was retrieved from amongst the bottom fauna from both sites in depths ranging from 1,577-2,002 m.

Etymology. The specific name *dieteri* is named after Dieter Fiege who has a good eye for chrysopetalids and has been generous in sending me deep-sea material in the past. Gender masculine.

ACKNOWLEDGMENTS

I am grateful to Dieter Fiege who kindly lent this interesting deep-sea chrysopetalid material for study, and to him and Jans Stecher (SMF) for providing additional information. I would also like to thank anonymous reviewers for critically reading the manuscript, Belinda Alvarez de Glasby for arranging the figures and the Northern Territory Museum for ongoing support during the duration of this project.

REFERENCES

- Aguirrezabalaga, F., San Martín, G., Petersen, M.E. and Ceberio, A. 1999. Presencia de *Dysponetus gracilis* Hartman, 1965 (Polychaeta, Chrysopetalidae) en las costas europeas, Golfo de Vizcaya. *Boletín de la Real Sociedad Española de Historia Natural (Sección Biológica)* **95**(3-4): 21-25.
- Dahlgren, T. G. and Pleijel, F. 1995. On the generic allocation of *Chrysopetalum caecum* (Polychaeta:Chrysopetalidae). *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* **92**: 159-173.
- Dahlgren, T. G. and Pleijel, F. 1998. Position and delineation of Chrysopetalidae and Hesionidae (Annelida, Polychaeta, Phyllodoidea). *Cladistics* **14**: 129-150.
- Dahlgren, T. G., Lundberg, J., Pleijel, F. and Sundberg, P. 2000. Morphological and molecular evidence of the phylogeny of nereidiform polychaetes (Annelida). *Journal Zoological and Systematic Evolutionary Research* **38**: 249-253.
- Desbruyères, D., Alayse-Danet, A.M., Ohta, S. and the Scientific Parties of the BIOLAU and STARMER Cruises, 1994. Deep-sea hydrothermal communities in Southwestern Pacific back-arc basins (the North Fiji and Lau Basins): Composition, microdistribution and food web. *Marine Geology* **16**: 227-242.
- Ehlers, E. 1864. *Die Borstenwürmer (Annelida Chaetopoda) nach systematischen und anatomischen Untersuchungen dargestellt*. Wilhelm Engelmann: Leipzig.
- Kisseleva, M. I. 1992. New genus and species of the family Chrysopetalidae (Polychaeta) from the Black Sea. *Zoologicheskii Zhurnal* **71**: 128-132.
- Laubier, L. 1968. Contribution à la faunistique du coralligène. VII. A propos quelques annélides polychètes rares ou nouvelles (Chrysopetalidae, Syllidae et Spionidae). *Annales de l'Institut Océanographique, Monaco* **46** (2): 79-144.
- Racovitza, E. G. 1896. Le lobe céphalique et encéphale des annélides polychètes. *Archives de Zoologie Expérimentale et Générale, Série 3*, **4**: 133-343.
- San Martín, G. 1986. *Acanthopale perkinsi* gen. et sp. n. (Polychaeta, Chrysopetalidae) from Cuba and Florida. *Zoologica Scripta* **15** (4): 305-312.
- Schmidt, M., Botz, R., Winn, K., Stoffers, P., Thissen, O. and Herzig, P. (in press). Seeping hydrocarbons and related carbonate mineralisations in sediment south of Lihir Island (New Ireland, Fore Arc Basin, Papua New Guinea). *Chemical Geology*.
- Tunnicliffe, V., McArthur, A.G. and McHugh, D. 1998. A biogeographical perspective of the deep-sea hydrothermal vent fauna. *Advances in Marine Biology* **34**: 353-442.
- Watson Russell, C. 1991. *Strepternos didymopyton* Watson Russell in Bhaud & Cazaux, 1987 (Polychaeta: Chrysopetalidae) from experimental wooden panels in deep waters of the Western North Atlantic. *Ophelia Supplement* **5**: 283-294.
- Watson Russell, C. 1997. Patterns of growth and development in the deep-sea worm, *Strepternos didymopyton* (Polychaeta: Chrysopetalidae). *Bulletin of Marine Science* **60**(2): 405-426.
- Watson Russell, C. 1998. Description of *Arichlidon* new genus and two new species from Australia: *Bhawania reyssi* redescribed and assigned to *Arichlidon* (Chrysopetalidae: Polychaeta). *The Beagle, Records of the Museum and Art Gallery of the Northern Territory* **14**: 159-176.
- Watson Russell, C. 2000a. Description of a new species of *Arichlidon* (Chrysopetalidae: Polychaeta) from the West Atlantic and comparison with the East Atlantic species *Arichlidon reyssi*. *Bulletin of Marine Science* **67**(1): 465-477.
- Watson Russell, C. 2000b. Family Chrysopetalidae. In: Beestey, P. L., Ross, G.J.B. and Glasby, C. J. (eds) *Polychaetes & allies: the southern synthesis. Fauna of Australia. Vol. 4A Polychaeta, Myzostomida, Pogonophora, Echiura, Sipuncula*. Pp. 121-125. CSIRO Publishing: Melbourne.

Accepted 23 November 2001

Short communication

Lectotype designation for *Gobius sarasinorum* Boulenger (Pisces, Gobioidi, Gobiidae, Gobionellinae)

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The gobionelline fishes of the genus *Mugilogobius* were recently revised by Larson (2001). The specimen intended to be the lectotype of *Gobius sarasinorum* Boulenger, 1897, was illustrated (Larson 2001: fig. 182) and it was referred to as the lectotype in the text. However, in an oversight, the specimen was not formally designated as lectotype, nor were the remaining syntypes designated as paralectotypes. This short note is intended to rectify this, so that the six lake-dwelling *Mugilogobius* species of Sulawesi cannot be confused.

The *Gobius sarasinorum* syntype specimen NMBA 1844, illustrated by Larson (2001) and held in the Naturhistorisches Museum, Basel, resembles the specimen illustrated in Boulenger (1897: plate 2, fig. 1), especially in head shape (so it might possibly be Boulenger's illustrated specimen), and it is in good condition. The specimen is from Lake Poso [= Poso Danau, central Sulawesi, Indonesia], collected by Drs

P. and F. Sarasin during 1893-96. It is hereby designated lectotype of *Gobius sarasinorum* Boulenger, 1897, to stabilise without ambiguity the name *sarasinorum*, and the following syntype specimens consequently become paralectotypes: NMBA 1843, 1 specimen; NMBA 1845, 1 specimen; NMBA 1846, 1 specimen; NMBA 2731, 1 specimen; BMNH (Natural History Museum, London) 1897.3.8.1-4, 4 specimens.

REFERENCES

- Boulenger, G. 1897. An account of the freshwater fishes collected in Celebes by Drs P. and F. Sarasin. *Proceedings of the Zoological Society of London* **1897** (Part II): 426-429.
Larson, H.K. 2001. A revision of the gobiid fish genus *Mugilogobius* (Teleostei: Gobioidi), with discussion of its systematic placement. *Records of the Western Australian Museum, Supplement No. 62*: 1-233.

Accepted 12 November 2001

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In the descriptive text, numbers from one to nine should be spelt out and numerals used for numbers over nine. For associated groups, numbers should be expressed consistently, e.g. 5 to 10, not five to 10.

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Bougainvillia balei Stechow, 1924: 58. - Stechow 1925: 199, fig. B. - Watson 1996: 78.

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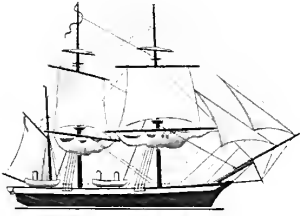
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Crowley, L.M. 1949. Working class conditions in Australia, 1788-1851. Unpublished PhD thesis. University of Melbourne.

Sadler, R.A. 1990. A new species of scincid lizard from western Arnhem Land, Northern Territory. *The Beagle, Records of the Northern Territory Museum of Arts and Sciences* 7(2): 29-33.



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